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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 7.] [1912.

XXXVI.—ELEPHANT GRASS.

A New Fodder Plant.

(*Pennisetum purpureum*, Schum.)

O. Stapf.

In the "Rhodesian Agricultural Journal" for June, 1910 (vol. vii., p. 1398), a new fodder grass was described as Zinyamunga or Napier's fodder. It was referred to *Pennisetum*, and compared especially with *P. spicatum* (*P. typhoideum*), the well known pearl millet. Last autumn specimens of the grass were received at Kew, and later a chemical analysis of the stalks and leaves was sent by Mr. H. Godfrey Mundy, Agriculturist and Botanist of the Department of Agriculture, Salisbury, Rhodesia.

The grass was easily identified as *Pennisetum purpureum*, Schum. (*P. Benthamii*, Steud.), a species of very wide range in Tropical Africa; but, common as it is, very little is known about its life history and uses, and even its limits as a species and its differentiation into varieties is not settled. It will therefore be useful to gather in a brief account all that is at present ascertainable about the grass.

Definition of the Species.—A tall perennial grass with a creeping rhizome (*Barter*). *Culms* erect, in tufts of up to twenty, usually 2–3 m., or occasionally up to 7 m. high and 1·2–2·5 cm. thick at the base, branched—particularly upwards—with the branches obliquely erect, terete, glabrous, smooth, excepting the uppermost internode, which is more or less hairy to tomentose in the upper part, the exserted parts sometimes covered with a glaucous bloom; nodes mostly exserted from the sheaths, all glabrous or most of them or only the uppermost with a ring of stiff long adpressed hairs. *Leaf-sheaths* terete, clasping the stem, striate, usually glabrous and smooth or more or less pubescent to hirsute with tubercle-based hairs near the top; *ligule* a narrow rim bearing a

(25633—6a.) Wt. 189—808. 1125. 9/12. D & S.

dense fringe of white hairs up to 2 or 3 mm. long; *blades* linear, not or slightly attenuated at the base and inserted on the sheath with a very marked hinge-fold, very long, tapering upwards to a fine point, 30–60 (rarely to 90) cm. long and up to 2·5 cm. wide, with a strong midrib, rounded on the back with a shallow channel above towards the base, and in the larger leaves with six or seven slightly prominent primary nerves on each side, dull green, sometimes slightly glaucous or faintly tinged with purple, more or less rough on both sides, glaucous beneath, usually more or less hairy above, particularly towards the base which sometimes becomes fringed, hairs fine, mostly rather stiff and long and often springing from small tubercles; margins spinulously scabrid, the spinules sometimes very firm and sharp. *Inflorescence* an erect, dense, cylindric spike, from 8 to 20 and even 30 cm. long and 1·5–3 cm. wide, usually yellow or tinged with brown, purple or quite blackish-purple, made up of deciduous spikelets or fascicles of spikelets, each spikelet or fascicle surrounded by an involucre of numerous bristles of unequal length, most of them 5–8 mm. long, one usually very much longer (1·2–2 or exceptionally to 4 cm. long), scabrid, one or several of the innermost and longest sparingly plumose towards the base, rarely all naked, often dark yellow, brownish or purplish towards the tips or blackish-purple from the base. *Spikelets* sessile or if in fascicles of 2–4, the lateral pedicelled, all lanceolate, more or less acuminate, 5–7 mm. long, glabrous, straw-coloured or tinged with brown or purple towards the tips of the florets, rarely blackish-purple all over, ♀ or, if fascicled, the lateral ♂, rarely neuter or all ♀. *Lower glume* suppressed or quite rudimentary, upper ovate to ovate-lanceolate, acute, 0·5–1 (rarely to 2) mm. long, subhyaline, 1-nerved or nerveless. *Lower floret* ♂ or more often barren; valve lanceolate, acute or acuminate, half as long to almost as long as the upper floret, more or less distinctly 3-nerved, rarely 1- or 5-, or even 7-nerved; palea linear-lanceolate, 2-nerved, shorter than the valve or in the barren florets much reduced or suppressed. *Upper floret* ♀ or in the lateral spikelets ♂; valve lanceolate, acuminate or rostrate-acuminate, very minutely scaberulous upwards, usually 5-nerved, nerves more or less prominent towards the tips; palea narrow, linear-lanceolate, slightly shorter than the valve, tips minutely 2-toothed. *Lodicules* 0. *Anthers* 2·5–3 mm. long, tips very minutely penicillate. *Styles* united all along; stigmas very slender, up to 4 mm. long, exserted from the tip of the floret. *Grain* unknown in the mature state; almost mature obovoid with a large, orbicular hilum and an orbicular-elliptic scutellum.

As will be seen from the description, several of the characters, such as the amount of indumentum, the number of spikelets in each partial inflorescence and their sex, the colour of the bristles of the involucre and the florets and the relative length of the glumes and valves and their nervation, vary within considerable limits. These variations appear to be independent of each other, and also to be unrelated to the geographical distribution. The most that can be said from the material at hand is that, on the whole, the nodes are usually bearded in specimens from the north-western and northern parts of the area, and usually glabrous in those from the south and

south-east. But perfectly glabrous nodes—glabrous from the beginning—may be found along with bearded ones in the same plant, when it is generally the lower nodes which are glabrous. The hairs which form the beard of the nodes spring mostly from the top of the internode and cover the annular sheath-joint, which itself is glabrous. Their distribution around the joint is frequently unequal, and on the older nodes they finally rub off. The waxy bloom so distinct in some samples is mostly confined to the upper parts of the internodes, but may also be seen on the backs of the blades and sheaths although it is much fainter there. This character too is apparently unconnected with others and does not coincide with definite divisions of the area. The purple or bronzy colouring of the inflorescence is just as erratic; but really dark spikes, blackish-purple all over, are rare. When the partial inflorescences are unispiculate, the spikelets are always bisexual with or without a male flower in the barren floret; but where there are two or more spikelets in a fascicle, the tendency is towards a reduction of the sexual organs in the outer spikelets, so that their upper floret becomes male and the lower neuter or, in extreme cases, both are neuter. This reduction may or may not be accompanied by a slight increase in length and nervation of the valve of the lower floret and sometimes also of the upper glume. Those fluctuations are generally found within the same inflorescence, the lower partial inflorescences being frequently 2–4-spiculate, whilst the upper are 1-spiculate, or they may only become evident by comparing different specimens from the same gathering. They are probably due to varying conditions of nutrition either within or without the plant, or may be due to sporting tendencies, in which case they might be expected to run through many generations and constitute more or less constant races. To sporting or mutation I would also trace the apparently erratic variation in the length of the bristles of the involucre, and especially of the longest, and in the degree to which the inner bristles are plumose, a character which is never very marked in this species and may even completely fail.

Considering the instability of all these characters it is clear that the discrimination of subordinate groups other than sports or mutations within *P. purpureum* in so far as it is based on them must result in the production of artificial divisions and can serve no useful purpose. I refrain therefore from subdividing the species or taking up Hackel's varieties *sambesiense*, *nudum* and *ternatum*,* and even doubt whether Leeke's species *P. flavicomum*, *P. pruinosum* and *P. pallescens*† can be maintained, as all the distinctive characters which he adduces seem to come within the limits of fluctuation just described. Unfortunately Leeke omitted to quote the specimens on which he bases his species, nor does he give any indication of their habitats except in the most general terms, as East Africa or Togo; but so far as they go, the species cited occur entirely within the area of *P. purpureum*.

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* In Schinz, Plantae Menyharthyanae in Denkschr. Ak. Wiss. Wien, vol. lxxviii, p. 400.

† Leeke, Abstamm. u. Heimat. d. Negerhirse, pp. 45–47.

As to the name *P. purpureum*, this was given by Schumacher to a plant collected by Thonning on the Gold Coast in the latter part of the 18th century. A specimen from the same collector and answering exactly Thonning's description came from Vahl's herbarium through Nolte to the British Museum, and it may be taken to constitute a cotype. Rendle* has already pointed out that it is identical with Bentham's *P. macrostachyum*,† which, owing to there being already a *P. macrostachyum* by Brongniart, was renamed *P. Benthamii* by Steudel,‡ a name until recently very commonly used for the grass which is the subject of this article. In fact, Bentham himself was quite aware of the probability of the identity of his and Schumacher's species, but was misled into describing the grass he had before him on account of the absence of the purple colouring insisted upon by Schumacher. We now know that no importance attaches to this as a taxonomic character. As to the other synonyms to be referred to *P. purpureum*, one, *P. nitens*, Hack.§ rests on *Gymnothrix nitens*, Anderss.,‖ and represents a robust yellow-spiked state, common in South East Africa, whilst the other *P. flexispica*,¶ K. Sch., was based on East African specimens which happened to have a more slender and therefore more flexible rhachis.

Distribution. The area of *P. purpureum* lies between 10° N. Lat. and 20° S. Lat. The northern limit runs from Sierra Leone through the great equatorial forest belt to the Cameroons and the basin of the Ubangi, then to the Nile (at 3° N. Lat.), Lake Victoria and German East Africa, where it reaches the coast in about 5° S. Lat. In the south the area is bounded by a line extending from Loanda in about 9° S. Lat. through Angola to Katanga and then across the Middle Zambesi to Eastern Rhodesia, whence in about 20° S. Lat. it strikes eastwards as far as Beira. Within this immense area it occurs mainly along watercourses and in marshy depressions, but also enters the bush and forest where open spaces afford sufficient light. Under favourable conditions it forms extensive reed jungles, as for instance in the delta of the Zambesi and along the Shire. Even in forests it is locally "only too common," as Welwitsch puts it. In the interior of Sierra Leone it ascends nearly to 900 m., and near its southern limit in the Melsetter district of Rhodesia to 1800 m., whilst in the Cameroons it is said to reach even the upper limit of woods. It is in rich marshland where it attains to a height of 7 m. and even more, whilst on drier soil, as in the savannas of East Africa, its culms are hardly more than 2 m. high. It also appears occasionally on abandoned cultivated land and has, in a few cases, been observed in a state of cultivation.**

Vernacular names. It is not surprising that a grass of so wide a distribution and striking appearance should have special names in

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* In Welwitsch, Cat. Afr. Pl. vol. ii, p. 190.
† In Hooker's, Nig. Fl. p. 563.
‡ Steudel, Syn. Pl. Glum. vol. i, p. 105.
§ In Bolet. Soc. Brot. vi (1888), p. 142.
‖ In Peters, Reise nach Mossamb. vol. vi (1864), p. 552.
¶ K. Schumann in Engl., Pflanzenw. Ost Afrne. C. (1895) 105.
** Kaiser, Acc. to Just's Jahresber. 1898, vol. i, p. 561.

many of the native dialects of Africa. The following is a list, compiled from publications and collectors' notes :—

Togo: Adá ; 'Elephanten grass' of German colonists.

Southern Nigeria: Esun funfun (Dodd); Esun (Millen); Esu pupu (MacGregor).

Belgian Congo. Lower Congo : Madiadi (Laurent); Ubanzi District, Mokango : Songo Songo (Bouckenaert) ; Yakoma : Awors (quoted by De Wildeman). Bangala District, Nouvelle Anvers : Sosongo, Libwakanike (De Giorgi). Territory of Rusisi Kivu : Matete (quoted by De Wildeman); Baraka : Mabingobingo (Dohet). Katanga : Dilenge (Verdick).

Angola : Mariango, Marianga, Marianko (Welwitsch, Buchner, Pogge), Massango (Welwitsch), Malenge-lenge, Malanga (quoted by Leeke).

Uganda, Madi : Maweengo-weengo (Grant).

Usambara : Mbuhu, Nguhu (Holst).

Rhodesia, Gutu : Zinyamunga (Kenny), marabagunda,* dumba-munga (Napier), miraba munga (Mundy).

Uses. Of the stems of the grass Grant† reports :—"The tall fences surrounding the residences of the Waganda King and people are of this useful reed ; the interiors of all Waganda houses are walled into compartments by it. A strip from it is so sharp that it is used for cutting up meat, and also cutting into fragments the victims of the King of Uganda."

The first mention of *P. purpureum* as a fodder grass is in Schinz, Plantae Menyharthianae‡ (1905), where the grass is stated to be good fodder for cattle. The note refers to an observation by Menyharth, a Hungarian missionary who from 1889 or 1890 to about 1894 collected in the neighbourhood of Boruma, not far from the Zambesi in the Eastern part of North-west Rhodesia. A remark to the same effect, "Species bovibus nutrimentum maxime idoneum," by Leeke§ (1907) rests on the authority of Herr Deistel, Government Gardener in the Cameroons, and Pilger in Engler, Pflanzenwelt Afrika‖ (1908) describes it as one of the best fodder grasses.

Independently of those sources, Mr. E. G. Kenny, Native Commissioner, Gutu, and Col. Napier, of Springs, Bulawayo, called the attention of the Agricultural Department of Rhodesia to the value of the grass as a fodder plant.¶ They first noticed it about 1908, "growing in the Gutu district in native lands and being used, as the natives explained, as a muti, or mushonga, to make the other crops grow." It was not growing wild there, and its origin was stated to be doubtful, but Mr. Swynnerton** states that

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* M'ramba munga in the report, reproduced on p. 315.

† Quoted by Oliver in Bot. Speke & Grant Exped. in Trans. Linn. Soc., vol. xxix, p. 172.

‡ In Denkschr. Ak. Wiss. Wien, vol. lxxviii, p. 400.

§ Leeke, Abstamm. u. Heimat. d. Negerhirse, p. 48.

‖ In Engler, Pflanzenwelt Africas, vol. ii, p. 145.

¶ Rhodes. Agric Journ. vol. vii, p. 1398.

** See Rendle in Journ. Linn. Soc. vol. xl, p. 231.

it grows in the Melsetter district, about 80 miles south-west of Gutu. Col. Napier has experimented with it, and a short account of his experiences, including a chemical analysis of the grass by the Chemist of the Rhodesian Agricultural Department, was published in the Rhodesian Agricultural Journal for 1909–1910, from which the following paragraphs are taken :—

(p. 1398.) "Like Pearl Millet it is reported to be an extremely good drought resister. (p. 1399.) Col. Napier and Mr. Kenny both state that it remains green on dry land late into the autumn and withstands frost to a remarkable degree. Col. Napier has tested it under most severe conditions and is firmly convinced of its economic value. He has now several acres planted on vlei ground on the Central Estates, and is hopeful that in spite of frost it will afford green feed late into the winter. Both cattle and horses eat it readily.*

"Like sugar cane the plant may be propagated either by subdivision of the roots or from cuttings or slips. It roots freely and is reported to grow rapidly after each cutting, thereby enhancing its value as a soiling crop. It seems probable therefore that in Napier's fodder we have found a hardy perennial plant of considerable value for winter feed and suitable for planting on light dry soil.

"**Chemical Analysis.**—The Agricultural Chemist of this Department has made the following analysis of a mature stalk of Napier's fodder which arrived at the laboratories in a partially dried condition, showing that it is comparable in feeding value to maize stalk roughage :—

	Per cent.
Water	55·33
Ether extract	0·84
Protein	3·10
(Total nitrogen converted to equivalent in protein.)	
Carbohydrates	21·16
Fibre	15·66
Ash	3·71
	100·00
Ether extract with chlorophyll removed therefrom ...	0·57
True protein	2·11

Since then another analysis was made from material grown on the Botanical Experiment Station,† Salisbury ; and this together with an analysis of sugar cane from the same station is reproduced below, with the permission of the Agricultural Department, Salisbury, Rhodesia.

* Col. Napier has formed so high an opinion of this crop that it is certainly worth a trial in other parts of Southern Rhodesia, and through his co-operation this Department is able to offer a limited number of roots f o.r. Gwelo, under the usual terms of co-operative experiments.

† Communicated to Kew in December, 1911.

"Composition of *Sugar Cane Fodder* (Saccharum officinarum) and *Zinvamunga Fodder* (M'ramba munga or Napier's fodder Setaria sp. or Pennisetum sp. ?) grown on the Botanical Experiment Station, Salisbury.

Particulars of Planting, &c.

—	Sample for Analysis.			
	Time Planted.	Collected.	Length of Stalk in Feet.	Length of Leaf in Feet.
Sugar cane	Jan., 1910 ...	July, 1911...	2	4
Zinyamunga	March, 1910 ...	,, ,,	8	2

The fodder had not been cut since planting.

Analysis.

—	Sugar Cane Fodder.	Zinyamunga Fodder.
	Per cent.	Per cent.
Water	73·63	61·81
Ether extract	0·22	0·29
Protein (Nitrogen X 6·25)	1·27	2·92
Carbohydrates	17·73	17·29
Woody fibre	5·32	14·77
Ash	1·83	2·92

"The amount of juice expressed from stripped stalks by passage between the steel rollers of an ordinary flattening mill used for rolling out metals was in each case as follows :—

—	Sugar Cane Stalks.	Zinyamunga Stalks.
	Per cent.	Per cent.
Juice expressed	56·6	21·3

"The juice of Zinyamunga was tasteless and of low sugar content, whilst that of sugar cane was sweet and contained 6·69 per cent. Sucrose (cane sugar) and 2·84 per cent. Glucose."

No analyses of the ash were made at Salisbury, but this gap is fortunately supplemented by Dr. F. Zeller,* of Victoria, Cameroons, who considers the rotting grass as well as its ash a very valuable manure ; and this may actually be the meaning of the statement of

* Tropenpfl., vol. xv. (1911), p. 357.

the Gutu natives that they plant it "to make the other crops grow." According to him 100 kilogr. of dried grass with a water content of 10 per cent. contain—

1·3	kilogr. N	corresponding to	6·5	kilogr.	sulphate of ammonia.
2·02	„ K_2O	„	4·0	„	chloride of potassium.
0·38	„ P_2O_5	„	1·9	„	superphosphate.
0·07	„ C_aO				
0·1	„ M_gO				

The best method of propagating the grass is probably by dividing the clumps or from cuttings. No mature seeds have come to hand so far. Searching the ample material of *P. purpureum* at Kew I came across one grain only, and this was not quite mature. Whether this means that the grass actually seeds rarely, or whether it may be that the grains escaped the collectors owing to the extreme readiness with which the spikelets with their involucres detach themselves, I am unable to say.

XXXVII.—ACCESSION OF TROPICAL AFRICAN PLANTS FROM 1907-1912.

The following list of Tropical African collections of Phanerogams and Vascular Cryptogams received at the Herbarium during the last 5½ years (from January 1st, 1907, to July 1st, 1912), has been drawn up by the Assistant for Africa.

The total number of specimens in these collections, excluding duplicates, is 22,286, of which 16,434 were presented and 5852 purchased. This is an increase of 7659 compared with the number received during the previous seven years (cf. *K.B.* 1907, p. 237). About 18,000 were received for determination, and each collection, except in a few cases, was dealt with on arrival. More than three-fourths of the specimens received have been named and mounted and have been incorporated or are ready for incorporation in the general herbarium.

Comparatively little has been published on these collections. Those specimens which belong to the families published in the parts of the Flora of Tropical Africa issued during the same period have as usual been recorded in that work. Many new species which have been worked out have been described in various numbers of the *Kew Bulletin*, and the following papers have been published in the same work:—Trees of the North-eastern Transvaal, by C. E. Legat (*K.B.* 1910, pp. 49–55); Notes on the Botanical Resources of Yola Province, Northern Nigeria, by Dr. J. M. Dalziel (*K.B.* 1910, pp. 133–142). The latter paper contains descriptions of three new species.

Allen, C. E. F.: Rhodesia, 242 specimens (unnamed), partly collected with **Dr. E. A. Nobbs.**

Anderson, J.: Gold Coast, 58 specimens (unnamed).

Appleton, Lt.-Col. A. F.: Rhodesia and Portuguese East Africa, 65 specimens, mostly *Gramineae* and *Cyperaceae* (unnamed).

Barraud, Miss: British East Africa and Pemba Island, 30 specimens (unnamed).

Battiscombe, E.: British East Africa ; Tana River and other localities, 304 specimens (unnamed); some communicated by Mr. D. E. Hutchins.

Bolus, Mrs. F., see KOLBE.

Brand, E.: British East Africa, 17 specimens (unnamed).

Brent, R. W.: Gold Coast, 12 specimens (unnamed).

Broun, A. F., and Mrs.: Eastern Sudan, 468 specimens (partly named).

Brown, E.: Uganda, 27 specimens (unnamed).

Burtt-Davy, J.: see LEGAT.

Chevalier, Dr. A.: Upper Guinea (chiefly French territory) and French Congo, about 1600 specimens (partly named).

Chipp, T. F.: Gold Coast, 130 specimens (unnamed).

Cockburn, N. C.: British East Africa (mostly), about 70 specimens (unnamed).

Colville, Mrs. O.: Nyasaland and North-east Rhodesia, 16 specimens and water-colour drawings (unnamed); British East Africa ; Aberdare Mts., 20 specimens (unnamed).

Cordeaux, Capt. H. E. S., C.M.G.: Somaliland, 1 specimen of *Cordeauxia*.

Craster, Mrs. W.: Rhodesia ; Salisbury, 80 *Gramineae* (unnamed).

Dalziel, Dr. J. M.: Northern Nigeria, various provinces, 1017 specimens (unnamed) ; transmitted by the Government of Northern Nigeria through the Imperial Institute.

Davy, E. W.: Nyasaland, specimens and seeds of *Widdringtonia* ; communicated by the Editor of the Gardeners' Chronicle.

Dawe, M. T.: Uganda, 100 specimens (unnamed) ; Portuguese East Africa and South-east Rhodesia, 222 specimens (unnamed).

Dennett, R. E.: Lagos, 24 specimens (unnamed) ; Southern Nigeria, 50 specimens (unnamed).

De Wildeman, Dr. E.: fragments of *Loranthaceae*, etc. ; see also SAPIN.

Dodd, H.: Lagos, 31 specimens (unnamed) ; communicated by N. C. McLeod, Assistant Conservator of Forests, S. Nigeria.

Drake-Brockman, Dr. R. E.: British Somaliland, 492 specimens (unnamed) ; Southern Abyssinia, 276 specimens (unnamed) ; communicated by the Colonial Office.

Dudgeon, G. C.: Gold Coast, 21 specimens ; Northern Nigeria, 20 specimens ; Southern Nigeria, 6 specimens (unnamed) ; communicated by Prof. W. R. Dunstan on behalf of the Imperial Institute.

Elliott, C. F.: British East Africa, 2 specimens (unnamed).

Elliott, W. R.: Northern Nigeria, 79 specimens (unnamed).

Engler, Prof. A., numerous duplicates of plants belonging to various orders.

Evans, A. E.: Gold Coast, 25 specimens (unnamed).

Evans, M. S.: British East Africa and Uganda, 44 specimens (unnamed).

Farquhar, J. H. J.: Southern Nigeria, 59 specimens (unnamed).

Foster, E. W.: Lagos and Southern Nigeria, 255 specimens (unnamed).

Fyffe, R.: Uganda, 274 specimens (unnamed).

Gairdner, Miss A. E.: North-west Rhodesia; Shesheke District, abont 300 specimens (partly determined at Kew by Miss Gairdner).

Galpin, E. E.: British East Africa, 29 specimens (unnamed).

Gibbs, Miss L. S.: Southern Rhodesia, 32 specimens (named).

Gilg, Dr. E.: see TESSMAN, ZENKER.

Gossweiler, J.: Angola, 2644 specimens (unnamed).

Heller, E.: British East Africa, 76 specimens (unnamed), collected on the Roosevelt Expedition to East Africa; communicated by G. S. Miller on behalf of the Smithsonian Institute.

Houard, Dr. C.: Sudan, 18 specimens of gall-bearing plants (unnamed); returned to collector after determination.

Howells, W.: Uganda, 2 specimens (unnamed).

Hutchins, D. E.: British East Africa, 87 specimens (unnamed); see also BATTISCOMBE.

Johnson, W. H.: Portuguese East Africa and Eastern Rhodesia, 285 specimens (unnamed).

Johnston, Sir H. H.: Liberia, 16 specimens and some dried fruits (unnamed).

Kässner, T.: Belgian Congo and East Africa, 442 specimens (mostly unnamed), purchased.

Kolbe, Rev. F. C.: Rhodesia, 22 specimens (unnamed); communicated by Mrs. F. Bolus.

Lamborn, Dr.: Near Lagos, 36 specimens (unnamed); communicated by Prof. E. B. Poulton.

Lane-Poole, C. E.: Sierra Leone, 114 specimens (unnamed).

Last, J. T.: Zanzibar Island, 363 specimens (unnamed).

Legat, C. E.: Northern Transvaal; Zoutpansberg, 74 specimens (unnamed), with 5 photographs, 2 maps and collector's notes; communicated by Mr. J. Burtt-Davy.

Lugard, Col. E. J.: Northern Nigeria, 22 specimens (unnamed).

Macaulay, Mrs.: Northern Rhodesia; near Mumbwa, 390 specimens (unnamed).

Maitland, T. D.: Southern Nigeria; Old Calabar, 14 specimens (unnamed).

McLeod, N. C.: see DODD.

Miles, A. C.: Ashanti, 16 specimens (unnamed).

Miller, G. S.: see HELLER.

Mundy, G.: Rhodesia, 1 specimen of *Schrebera mazoensis*.

Newland, Capt. A. E.: British East Africa ; Mt. Elgon, 6 specimens (unnamed).

Nobbs, Dr. E. A.: see ALLEN.

Northey, Miss M.: British East Africa, book of coloured drawings of plants for determination ; returned to Miss Northey.

Parsons, Dr. A. C.: mostly Northern Nigeria, 201 specimens (unnamed), and a few water colour drawings.

Pearson, Prof. H. H. W.: South Angola and Great Namaqualand, 912 specimens (unnamed) ; collected on the Percy Sladen Memorial Expedition in South-west Africa, 1908–1909.

Poulton, Prof. E. B.: see LAMBORN.

Powell, H.: British East Africa, 178 specimens (unnamed).

Purves, J, M.: Nyasaland, 36 specimens (unnamed).

Rogers, Rev. F. A.: Rhodesia and a few from Belgian Congo, 2143 specimens (unnamed), purchased ; partly communicated by Dr. S. Schönland.

Routledge, W. S.: British East Africa, 229 specimens (unnamed).

Rudatis, H.: Cameroons, 58 specimens (unnamed) ; communicated by Dr. H. Schinz.

Sapin, A.: Belgian Congo, 33 specimens (named) ; communicated by Dr. E. De Wildeman.

Scheffler, G.: British East Africa, 299 specimens (mostly named), purchased.

Schlechter, Dr. R.: Upper Guinea, 373 specimens (named), purchased.

Schinz, Dr. H.: Somaliland, 2 grasses ; see also RUDATIS.

Schönland, Dr. S.: see ROGERS.

Shaw, B. B.: Northern Nigeria, 109 specimens (unnamed).

Smythe, C. W.: Sierra Leone, 202 specimens (partly named) ; partly communicated by the Colonial Office ; see also UNWIN.

Stocks, J.: Portuguese East Africa, about 250 specimens (unnamed).

Stordy, R. J.: Southern Abyssinia, 27 specimens, mostly grasses (unnamed).

Swynnerton, C. F. M.: Portuguese East Africa (Gazaland) and South-east Rhodesia, 882 specimens (named), purchased.

Talbot, P. A. and Mrs.: mostly Southern Nigeria, 1024 specimens (unnamed) ; 520 specimens (named), communicated through Dr. A. B. Rendle.

Tessmann, G.: Spanish Guinea, 713 specimens (unnamed), purchased ; received through the agency of Dr. E. Gilg.

Thomas, N. W.: Southern Nigeria, about 1400 specimens (unnamed).

Thompson, H. N.: Southern Nigeria, 16 specimens ; Gold Coast, 81 specimens (unnamed).

Thonner, F.: Belgian Congo, 35 specimens (named).

Tremearne, Capt. A. J. N.: Northern Nigeria, 30 specimens (unnamed).

Unwin, A. H.: Southern Nigeria, 144 specimens; Sierra Leone (collected with C. W. Smythe), 38 specimens (unnamed).

Ussher, C. B.: Uganda; Mabira Forest, 100 specimens (unnamed).

Wellman, Dr. F. G.: Angola, 63 specimens (unnamed).

Williams, J. L.: Southern Nigeria; Calabar, 56 specimens (unnamed).

Yates, C. C.: Northern Nigeria, 76 specimens (unnamed).

Zenker, G.: Cameroons, 1000 specimens (mostly named), purchased; received through the agency of Dr. E. Gilg.

XXXVIII.—VISIT OF THE ROYAL SCOTTISH ARBORICULTURAL SOCIETY TO DEESIDE.

W. Dallimore.

By permission of the Director I was enabled to take part in the annual excursion of the Royal Scottish Arboricultural Society which took place this year on Deeside and lasted from June 24th to June 29th. The estates visited included Balmoral, Ballogie, Finzean, Crathes and Durris.

Leaving Aberdeen in motor cars on the afternoon of June 24th, the valley of the Dee was traversed to Braemar, thus enabling members to form a general idea of the wide extent of forest existing throughout the region, for from the time Aberdeen is left until Braemar, 60 miles distant, is reached, a great deal of land on either side of the valley is well wooded. Much importance is attached to this region, for it contains some of the best timber grown in the British Isles. There is a considerable amount of land worth planting; the railway runs for 40 miles along the valley and there is a good outlet for timber in Aberdeen.

The planted area contains woods of all ages, from those newly planted, to others which have passed into the hands of the timber merchant, and a large percentage appears to be well managed. The heaviest stands of timber exist between Banchory and Dinnet, but above Ballater there is also a large amount of good timber.

Natural disadvantages to successful forestry, such as wet ground and scarcity of soil, occur on some estates and the usual injuries due to game and vermin are noticeable. With regard to the latter the fact cannot be too strongly emphasised that the best results from forestry operations can only be expected after the exclusion of deer, hares and black game from young plantations, and with the wholesale destruction of rabbits and squirrels. Moreover, if woods are to be replenished by natural regeneration, deer must not be admitted even when the trees are mature. A visit to Ballochbuie forest illustrates this, for where the forest is open to deer scarcely a young tree is to be seen, but in fenced areas a dense crop of vigorous young trees covers the ground.

The results of various methods of thinning adopted on different estates are very noticeable, the mature crops in some places being much denser than in others whilst there is little to choose between the cubical contents of average trees. There is no doubt that one all-round system of thinning would be impracticable as conditions vary so widely in even a small area, yet one has to admit that less thinning in many cases would be advisable.

Fewer new plantations are being formed than one would have expected, considering the quantity of waste ground available and the fact of the region having proved itself to be peculiarly adapted for the growth of trees. Though difficult to form anything like an accurate opinion from a hurried visit, it would appear that no greater area of land is being planted than that which is being cleared.

Here and there plantations are noticed in unsuitable places such as on very high and exposed land, and in such cases the trees are usually poor and stunted. At present there is plenty of land lying idle at fairly low elevations and moderately well sheltered. Until such land is planted up there appears, therefore, to be little reason for undertaking the hazardous experiment of planting the less favourable positions.

Taking the woods visited as a fair sample of those existing throughout Deeside, however, they impress one favourably, and were the woods in every district of the country in as good order, forestry in the British Isles would be in a flourishing condition.

The large area of woodland has made the district one of the principal training centres in the country for young foresters, and many of the leading foresters of the day have received a portion of their training on one or other of the estates. A difficulty has, however, been found in the past by young foresters, in obtaining experience in anything except practical work. To meet this want the authorities of Aberdeen University and the North of Scotland College of Agriculture have instituted courses of lectures on the theoretical and scientific sides of forestry for men who have had practical training.

A course of instruction which has proved to be very popular extends from October to March. This is purely academical and includes lectures, laboratory work and occasional excursions to woods in the vicinity for demonstration purposes.

Last winter 24 students, 11 of whom were young foresters in the North of Scotland, attended the course, the ages of the men being between 18 and 22. The fees for the course amount to three guineas and the cost of board and lodging to each student is about 15 shillings a week. The expense is sometimes borne by the student and sometimes by his employer, or the cost may be divided. There is also an opportunity for men to obtain County Council Bursaries valued at from £10 to £15 each.

A four weeks' course of instruction for foresters who cannot leave their employment for a longer period has also been arranged. No fee is charged for this course and students are given the free use of microscopes and any other instruments they may require. Men of all ages between 17 and 60 enter as students, and in many cases their out-of-pocket expenses are paid by their employers.

As in the other course, daily lectures are given by Mr. Dawson, the principal forestry official, and all laboratory and demonstration work is supervised by him or by his assistants.

Situated as Aberdeen is, close to one of the best wooded areas in the country, the university and college officials are peculiarly well placed for dealing with the scientific training of practical foresters, for it is but a short journey from the lecture room to the forest; in fact a tram ride of a few minutes, in any one of three directions, is all that is necessary, whilst a journey of half an hour by train opens up a still wider area. In addition to these facilities an experimental plot is about to be established by the Agricultural College and the University.

On Tuesday and Wednesday, June 25th and 26th, the King's woods on the Balmoral Estate were visited. These cover an area of 10,000 acres or about one fourth of the estate. The principal points inspected were Ballochbuie Forest, Garmaddie Wood, Invergelder and Craiggowan, Balmoral Grounds and Abergeldie.

Ballochbuie Forest is one of the few remaining old natural forests of Scotland, and it is to be preserved as far as possible in its primitive condition. Mr. Michie, the King's Factor, gives the age of the older trees as nearly 300 years, but the greater number are much younger. A link with the past was pointed out by the presence of a large dead pine, computed to be 400 years old, with its trunk badly hacked about. This is said to have been done by highlandmen a couple of centuries or so ago, who were in the habit of cutting pieces of resinous wood from both living and dead trees to use for lighting their houses.

The forest occupies fairly steep hillsides and valleys between the elevations of 1000 and 1800 feet and is composed exclusively of Scots pine. The trees average from 70 to 80 feet in height below the 1500 feet level. At 1250 feet the largest tree seen girthed 11 feet 10 inches at 5 feet above the ground and 14 feet at the ground level; there are not many trees, however, which approach this size, and six consecutive trees girthed 4 feet 5 inches; 3 feet 5 inches; 5 feet 3 inches; 3 feet 7 inches; 2 feet 4 inches; and 3 feet 5 inches respectively. These trees are probably from 100 to 150 years old. From 1250 to 1500 feet elevation the trees gradually dwindle in both height and girth measurements, and above the higher altitude they fail to reach a commercial size, until at 1800 feet they are mere bushes scarcely larger than the junipers among which they grow.

Throughout the greater part of the forest there is a marked absence of young trees; a few up to two years of age were noticed, but nothing older. This is accounted for by the presence of deer, for on areas which have been fenced natural regeneration is taking place.

The stand of timber is not very heavy over a considerable portion of the forest, the trees having been over-thinned in the past. The quality of the wood is, however, good; and, considering altitude and poor soil, the general crop may be said to compare favourably with many Scots pine woods which are growing under better conditions.

Much of the soil is light and gravelly, overlying granite. In exposed places there is but a thin layer, but a fair depth occurs in sheltered places between rocks.

Over the greater part of the forest there is a considerable undergrowth of *Juniperus communis*, *Genista anglica*, *Calluna vulgaris*, *Erica cinerea*, *E. Tetralix*, *Vaccinium Myrtillus*, *V. Vitis-idaea*, *Empetrum nigrum*, *Lomaria Spicant*, and various orchids, of which *Orchis maculata* and *Habenaria odoratissima* were most plentiful. Near the summit of Craig Daiyn, 1780 feet, *Arctostaphylos Uva-ursi* occurs among dwarf pines, junipers, and heather, and about the higher points *Listera cordata* was found beneath the heather.

From the summit of Craig Daiyn a glorious view of the forest and hills and valleys of the surrounding country is obtained, and on an exposed point a cairn has been erected, which contains a stone bearing the following inscription: "Queen Victoria entered into possession of the Ballochbuie, 15th May, 1876. 'The bonniest plaid in Scotland.'" The last sentence is said to have reference to a local tradition that Ballochbuie Forest was at one time sold by a McGregor to a Farquharson of Invercauld for a tartan plaid.

Garmaddie Wood.—The trees in this wood number about 250 to the acre, and average about 15 cubic feet of timber each. Other Scots pine woods contain larger trees, and there are larch woods of good quality on the estate. With regard to larch, Mr. Michie is of the opinion that more satisfactory crops of timber can be raised from Tyrolese seed than from seed ripened in Scotland. Japanese larch is not grown.

A plantation of Douglas fir planted in 1886 at an elevation of 1020 to over 1100 feet has made good progress. The taller trees are 45 to 50 feet high. In the vicinity of this wood a group of trees of *Pinus Cembra* planted 24 years ago ranged from 20 to 25 feet in height, *P. monticola* growing near by being about 5 feet higher.

At present all the timber cut is used for estate purposes.

The gardens contain numerous well-developed conifers, which were planted about the year 1860. Some of the best are *Pseudotsuga Douglasii*, 70 feet high by 7 feet 4 inches in girth; *Abies Lowiana*, 45 to 50 feet high; *A. magnifica*, 50 feet by 4 feet 5 inches; and *A. grandis*, 60 feet by 5 feet 9 inches. All the girths were taken at 5 feet above the ground.

A number of good silver firs are to be seen at Abergeldie; the best one girths 12 feet at 5 feet high. They are growing at an elevation of 800 to 900 feet, and natural regeneration takes place.

The Invercauld woods and gardens belonging to Mr. Farquharson were also visited. Perhaps the most interesting tree noted was a horse-chestnut growing at an elevation of 1100 feet. Its height was 40 to 45 feet, and it had a large and shapely head. Near to this tree a large ash, 50 feet high with a girth of 11 feet 11 inches, was seen. A plantation of *Picea alba*, the trees 15 to 20 feet high, and numerous good specimen conifers were noticed. The destructive habits of black game were very noticeable in a plantation of young larch, almost every tree having lost its leader through the ravages of these birds.

On Thursday, June 27th, Ballogie and Finzean estates were visited. These are situated in Kincardineshire, about 10 to 15 miles west of Banchory, in what is said to be one of the heaviest timbered districts in Scotland.

Ballogie, the property of Mr. W. E. Nicol, includes about 3000 acres of forest, which is in all stages of development from newly made plantations to woods ready for cutting. One section is now being clear-cut, and two sawmills are at work converting the timber into posts, rails, boards for building purposes, staves for fish barrels, &c. For the latter purpose there is a good demand in Aberdeen and the neighbourhood. The Scots pine occupy the major portion of the woods, but there is also a good deal of larch.

The custom prevails on this estate of leaving woods unthinned until the thinnings are of scaffold pole size, which may be 30 years from the time of planting. A wood of Scots pine extending over 200 acres, which had been planted about 27 years, now numbers about 2500 trees to the acre, and although no systematic thinning has been done, the number of suppressed trees is not very considerable, although in the past small ones have died and fallen. So far as can be seen, the trees generally are making satisfactory height and girth growth. The ground had previously carried Scots pine and larch. This had been cut in blocks of 50 acres. When replanted, trouble was caused by pine weevils, but this was overcome to some extent in the later plantings by thoroughly loosening the surface soil before replanting. The cost of planting was about £2 15*s.* an acre. An older wood composed of pine and larch carries 200 trees to the acre, the cubical contents averaging about 4000 feet. The trees are about 90 years old. In this wood the little ground orchid *Goodyera repens* was plentiful.

In the gardens surrounding Ballogie House numbers of very fine Scots pine and larch were seen. Of the former species, the largest example measured 108 feet in height and 11 feet 8 inches in girth at 5 feet from the ground. It is 200 years old, and contains about 200 cubic feet of timber. Numerous larch contain 60 feet and upwards. Amongst specimen conifers the following were notable :— *Abies nobilis*, 77 feet high, girth 6 feet 11 inches ; *A. Nordmanniana*, height 79 feet, girth 9 feet ; *A. Lowiana*, 74 feet by 5 feet 10 inches ; *Pseudotsuga Douglasii*, 107 feet by 9 feet 5 inches ; another of the same species, 97 feet by 10 feet ; *Picea sitchensis*, 86 feet by 11 feet 9 inches ; *Libocedrus decurrens*, 30 feet. In another part of the estate, Ballnacraig, two walnut trees, each about 55 feet high, girth 9 feet 1 inch and 9 feet 6 inches respectively, the former at 5 feet, the latter at 3 feet above the ground. These are growing at an elevation of 600 feet and ripen fruits occasionally. An ash tree near by girths 15 feet 8 inches and measures 16 feet to the first branch.

Finzean.—Dr. Farquharson's woods at Finzean contain probably the heaviest stands of timber seen during the tour. A wood of natural-grown larch 200 acres in extent, known as Easter Clune Plantation, contains a fine lot of trees about 40 years old. About the lower parts the cubical contents are about 1800 feet to the acre, the crop being somewhat lighter about the higher points.

Approaching Finzean House the road is bordered on either side by plantations of Scots pine. The trees are remarkable alike for height, clean trunks and girth. They are said to average 250 trees to the acre, and the cubical contents are said to be upwards of 8000 feet to the acre. There was, however, no opportunity of checking these figures. The trees are known locally as "Dr. Farquharson's Walking-sticks." In a mixed wood behind the house a number of very fine larch measuring up to 100 feet in height and 8 feet in girth was noted. Several well-grown specimens of *Tsuga Mertensiana* and *Juglans regia* were also seen.

On Friday, June 28th, a visit was paid to the sawmills of Messrs. A. and G. Paterson, of Banchory, where large quantities of wood from the forests are dealt with. The two great woods of the district, pine and larch, were most in evidence, but Douglas fir and other kinds were also seen. The manner in which timber is injured by squirrels was very noticeable in some of the timber which had been cut up. In some cases the damage is so serious that large sections of trees have to be discarded. Messrs. Paterson have very kindly presented planks of Douglas fir, larch, *Abies nobilis*, &c., for the Forestry Museum at Kew.

Crathes, the estate of Sir Thomas Burnett, Bart., was also visited. Woods of a similar character to those already seen were passed through, and numerous specimen trees in the gardens examined. The fine hedges of yew are one of the principal features of the gardens. These are upwards of 12 feet high and from 8 to 12 feet through. They were planted when the castle was built in 1596, and are in excellent health.

Durris.—A visit to Durris, the Kincardineshire estate of Mr. H. J. Baird, completed the programme. Here a greater variety of trees were found under forest conditions than on the other estates visited. Douglas fir and Sitka spruce planted upwards of 30 years ago look very healthy and are making satisfactory progress. Two plantations of Sitka spruce (*Picea sitchensis*), growing at elevations of 700 and 900 feet respectively, were visited. The trees are 34 years old and are planted on bog land. At the time of planting, drains were opened eight or nine yards apart which still carry off a considerable amount of water. The first plantation visited covers about 83 acres. It was originally planted with a mixture of trees, chiefly Douglas fir and Sitka spruce. In the drier places the firs are the larger, but in most places the spruces have suppressed all other trees. The wood has not been thinned, but the trees do not appear to have suffered on that account. The other wood is entirely Sitka spruce. I was informed that Professor Mayr, of Munich, considered these the two best plantations of Sitka spruce in Europe. From their condition they go far to justify the extensive plantations of this tree which are being made in some quarters on wet exposed land.

The gardens at Durris are extremely interesting, for they are attractively situated, and contain a good collection of trees, shrubs and other plants. Many of the trees are very well developed, and numerous conifers, ranging in height from 70 to 100 feet, retain their branches to the ground. *Abies grandis*, *A. Lowiana*, *A. Pinsapo*, *Thuya plicata* and *Pseudotsuga Douglasii* were prominent. A specimen of the latter, 72 years old, measured 106 feet in height

and 12 feet in girth at 5 feet from the ground. Its estimated timber contents are 300 cubic feet.

A large nursery, devoted chiefly to the raising of young forest trees, contained a good collection of young ornamental trees and shrubs also. Amongst the latter was a fine specimen of the Tasmanian *Athrotaxis laxifolia* about 12 feet high, which had stood uninjured for eight years, although on one occasion the temperature fell to zero.

XXXIX.—A NEW BUCHU FROM SOUTH AFRICA.

(*Barosma Peglerae*).

R. A. Dümmer.

The terms *Buchu*, *Bukku*, or *Bucco* are loosely applied by natives of the Cape Colony to various members of the genera *Agathosma*, *Diosma* and *Barosma* of the Natural Order *Rutaceae*, which, owing to the oleaginous and mucilaginous properties contained within their leaves, constitute a domestic medicine of no little repute.

By infusing the leaves in vinegar, brandy or 'dop,' their therapeutic properties are freed and the subsequent "Buchu Vinegar" or "Buchu Brandy" is then used for sundry internal complaints, although as MacOwan[1] remarks, "in these cases its chief value perhaps is the excuse and cover it affords for the occasional dose of alcohol." Be that as it may, their value as embrocations in sprains, contusions, &c., is held in high esteem, nor have their importance in alleviating rheumatic troubles been questioned.

The standard Buchus, however, comprise only three species of *Barosma*, namely, *B. serratifolia*, Willd., *B. crenulata*, Hook., and *B. betulina*, Bartl. and Wendl. f., known in the trade as "Longs," "Ovals" and "Short-broad," "Obovate" or "Rounds" respectively, though in recent years the leaves of the latter have been preferred and constitute now the "Folia Buchu," or "Folia Bucco" of the British Pharmacopoeia. These are chiefly valued as a diuretic, in catarrh of the bladder and in prostatic troubles.

The encouraging prices realised within recent years on the London markets have materially stimulated the industry of Buchu collecting, and with a view to furthering this stimulus, Mr. N. S. Pillans[2] has written a preliminary article, pending the results of certain investigations instituted by the Government, relating to the subject; the writer therein touches upon the history of the industry, mode of collecting and drying, quoting also statistics which indicate the steady increase in export and prices realised.

As considerable confusion has hitherto prevailed regarding the taxonomic limits of certain of the species and attempts at adulteration have not been infrequent, a critical revision of the genus has been undertaken with a view to facilitating the recognition of standard species, their occasional substitutes and the detection of spurious Buchus. These have been figured and will appear with descriptions in a subsequent issue of the Agricultural Journal of the Union of South Africa.

Specimens of a Buchu communicated to Kew during the year 1907, collected by Miss Alice Pegler on grassy slopes at the Qolora

[1] Agric. Journ., Cape of Good Hope, vi, 146 (1893).
[2] Agric. Journ., Cape of Good Hope, xxxvii., 252 (1910).

Mouth, Kentani, in the Eastern Regions of Cape Colony, appear to be new to science, and in order to direct attention to this species, which may be worth exploiting, this preliminary note with a diagnosis of the new species has been prepared.

Barosma Peglerae, *Dümmer*,* habitu *B. lanceolatae*, Sond. (sensu lato) similis, sed foliis latioribus ellipticis subtus fere epunctatis.

Planta perennis e basi lignosa ramosa, caulibus lignescentibus ascendentibus gracilibus ad 18 cm. altis simplicibus vel pauciramosis teretiusculis castaneis inferne nudis glabris cicatricibus prominulis superne dense foliatis minute puberulis. *Folia* alternatim disposita vel subopposita, subimbricata vel patula, brevissime petiolata, oblongo-elliptica, apice obtuso glandula notata, 1–1·5 cm. longa, 4–5 mm. lata, coriacea, mox glabra, supra nitentia, subconvexa, laevia, costa vix prominente, subtus pallidiora, eglandulosa vel glandulis paucis inconspicuis conspersa, margine paulo incrassata recurvaque fere integra et glandulis impressis ornata. *Flores* lilacini (fide *Pegler*), apicem versus ramulorum racemose dispositi, axillares, solitarii, gemini ternive, pedunculis filiformibus puberulis mox glabris 0·5–1 cm. longis bracteis basilaribus minutis munitis. *Calyx* glaber, 5-partitus, segmentis late deltoideis obtusis 1 mm. longis apicem versus glanduliferis denticulatis. *Petala* elliptico-oblonga, obtusa, 5 mm. longa, 2·5 mm. lata, in sicco albida. *Stamina* glaberrima, petalis aequilonga vel longiora, antheris glandula parvula terminatis; staminodia lanceolata, subacuta, 2 mm. longa, glandula obsoleta apicali notata, margine ciliolata. *Pistillum* glabrum, interdum abortivum, stylo carnosulo petalis fere duplo brevius, stigmate truncato.

1. Branch with Flowers.
2. Leaf. 3. Flower.

* The following is a translation of the Latin diagnosis :—

A *perennial* plant developing annual leafy and flowering shoots from a woody root-stock ; shoots slightly woody, ascending, slender, 7–9 inches high, simple or sparingly branched, nearly terete, chestnut brown, leafless, glabrous, and with prominent leafscars or aborted leaf-buds towards the base, densely leafy and minutely downy towards the apex. *Leaves* alternately disposed or subopposite, subimbricate or spreading, very shortly petiolate, oblong-elliptic with an obtuse gland-tipped apex, $\frac{2}{5}$ to over $\frac{1}{2}$ in. long, $\frac{1}{6}$–$\frac{1}{5}$ in. broad, leathery, glabrous, shiny, light green ; slightly convex and smooth above with a scarcely prominent midrib, paler below with a few scattered inconspicuous glands, the margin slightly thickened and recurved, almost entire and impressedly glandular. *Flowers* lilac, racemosely disposed towards the ends of the shoots, axillary, solitary, in pairs or threes, the peduncles filiform, puberulous or glabrous, $\frac{1}{4}$–$\frac{1}{3}$ in. long, subtended by minute basilar bracts. *Calyx* 5-partite, glabrous, with broadly deltoid obtuse segments $\frac{1}{24}$ in. long, gland-bearing towards their apices, and denticulate. Petal elliptic-oblong, obtuse, $\frac{1}{5}$ in. long, $\frac{1}{10}$ in. broad. *Stamens* entirely glabrous, equalling the petals in length or longer, the anthers terminated by a small gland ; staminodes (infertile stamens) lanceolate, subacute, $\frac{1}{12}$ in. long, furnished with an obsolete apical gland, ciliolate. *Pistil* glabrous, occasionally aborted ; style thickish, half as long as the petals and terminated by a truncate stigma.

South Africa. Eastern Region: Kentani; Qolora Mouth, grassy slopes, 30 m., *Pegler*, 33.

The species exhibits an affinity to forms of *Barosma lanceolata*, Sonder, but is readily distinguished by the broader, elliptic leaves, which are moreover inconspicuously glandular on their lower surfaces. Whether these will subsequently be of pharmaceutical importance must be decided by experiment; their size and glabridity however favour their trial, and though the glands are inconspicuous, pharmacologists assert that the value of the leaves is not solely dependent on the oil-extractive, but is intimately associated with their mucilaginous contents.

XL.—DIAGNOSES AFRICANAE, L.

1391. **Adenandra Schlechteri**, *Dümmer* [Rutaceae-Diosmeae]; ab *A. brachyphylla*, Schlechtendal, caulibus simplicibus, foliis majoribus obtusis subtus eglandulosis, floribus minoribus, pedicellis calycibusque albo-hirsutulis distat.

Caules simplices, fere stricti, graciles, lignescentes, inferne brunei, teretes, apicem versus citrini, angulati, puberuli, ad 5 dm. longi, foliis obtecti. *Folia* imbricata, brevissime complanato-petiolata, anguste elliptica vel obovato-elliptica, obtusa, 5–8 mm. longa, 3–4 mm. lata, coriacea, laete viridia, utrinque glabra, margine incrassata paulo recurva glandulisque impressis inconspicuis ornata. *Umbella* 8–10-flora, pedicellis albo-hirsutulis ad 8 mm. longis. *Calyx* 5-partitus, circiter 5 mm. longus, extra albo-hirsutulus, intra glaber, lobis ovatis concavis subacutis ciliatis. *Petala* brevissime et late unguiculata, late ovata, subacuta, tota 7 mm. longa, 4 mm. lata, glabra, albo-rosea. *Stamina* fertilia 2 mm. longa, antheris majusculis parce pilosis et glandula stipitata terminatis; staminodia staminibus fere duplo longiora, capitata, filamentis patenter pilosis. *Stylus* brevissimus, discum vix excedens; stigma truncatum.

South Africa. Coast Region: Bredasdorp Div.; Koude Rivier, 120 m. *Schlechter*, 10,467.

1392. **Agathosma Burchellii**, *Dümmer* [Rutaceae-Diosmeae]; *A. chortophilae*, Ecklon et Zeyher, affinis, sed habitu patulo, ramulis castaneis, foliis longioribus obtusis supra convexis subtus sulcatis omnino puberulis, umbellis paucifloris facile distinguenda.

Frutex circiter 6 dm. altus, divaricato-ramosus, partibus junioribus ubique corollis exceptis puberulis, ramulis ultimis castaneis gracilibus ad 5 cm. longis foliis obtectis. *Folia* plerumque ternata, primo ascendentia, mox patentia, internodiis longiora, brevissime complanato-petiolata, linearia, obtusa, 5–8 mm. longa, 0·7–1 mm. lata, carnosula, supra convexa, subtus sulcata, marginibus incrassatis revolutis valde impresso-punctatis. *Flores* axillares, interdum solitarii vel in umbellas terminales 2–5-floras dispositi, pedicellis ad 6 mm. longis bracteolatis suffulti. *Calyx* 5-partitus, extra puberulus, intus glaber, segmentis ovato-oblongis obtusis marginibus involutis ciliolatis glandulis ornatis. *Petala* patentia, anguste obovato-oblonga, 2 mm. longa, alba, roseo-tincta, glandula glabra aut pilifera fusca terminata, margine inferne ciliolata. *Stamina* glabra, petala aequantia; staminodia anguste elliptica, acuta, pubescentia,

staminibus triplo vel quadruplo breviora. *Stylus* glaber, stamina vix superans, apice obtuso. *Carpella* 4 mm. longa, glabra, atrocastanea, muricato-glandulosa.

South Africa. Coast Region: Riversdale Div.; dry hills near Spiegel River, Dec. 1814. *Burchell*, 7205.

A species with the facies of *Barosma microcarpa*, Sonder, but the umbellate disposition of the flowers suggests its approximation to the closely allied and scarcely separable genus *Agathosma*.

1393. **Kalanchoe Ellacombei**, *N. E. Brown* [Crassulaceae]; affinis *K. platysepalae*, Welw., sed planta hirsutior sepalis acuminatis et corolla glanduloso-puberula.

Herba annua vel biennis, erecta, 3·5–5 dm. alta. *Caulis* 3–6 mm. crassus, inferne glaber, superne pilis glandulosis patulis conspicue pubescens; rami oppositi erecti, subparalleli, racemis bifidis parallelis 5–10 cm. longis multifloris terminati, glanduloso-pubescentes. *Folia* opposita, sessilia, 3–9 cm. longa, 0·7–3 cm. lata, anguste oblonga vel oblongo-lanceolata, obtusa vel subacuta, integra, inferiora glabra, superiora utrinque glanduloso-puberula. *Flores* alterni. *Bracteae* 3 mm. longae, lineares, acutae, deciduae. *Pedicelli* 3 mm. longi, glanduloso-pubescentes. *Calyx* 7–8 mm. longus, 4-lobus, glanduloso-puberulus, viridis; lobi 5–6 mm. longi, 2·5 mm. lati, ovato-lanceolati, acuminati. *Corolla* 4-loba, aurantiaca, extra glanduloso-puberula; tubus 1 cm. longus; lobi 5 mm. longi, 3·5–4 mm. lati, elliptici, obtusi, subulato-apiculati. *Stamina* inclusa. *Squamae hypogynae* 2·5 mm. longae, lineares, submembranaceae.

Tropical Africa. Rhodesia: Livingston and by the River Zambesi 5 miles above Victoria Falls, *Ellacombe*.

1394. **Begonia (Fusibegonia) parva**, *Sprague* [Begoniaceae]; affinis *B. Mannii*, Hook. f., a qua foliis minoribus minus obliquis, floribus minoribus, femineis solitariis, antheris longioribus recedit.

Caulis herbaceus, circiter 3 dm. longus, teres, circiter 4 mm. diametro, pilis stellatis brunneo-pubescens; internodia 2–4 cm. longa. *Folia* ovata, acute acuminata, apice recurva, basi leviter inaequaliter cordata, 10–11 cm. longa, 5 cm. lata, supra subopaca, glabra, laevia, subtus pilis stellatis brunneo-pubescentia, nervo medio prominente; nervi laterales utrinque circiter 4, satis obliqui; petioli plus minus rubri, 1·5–3·5 cm. longi; stipulae lanceolatae, acute acuminatae, 1·7–2 cm. longae, extra stellato-pubescentes. *Perianthii segmenta* saturate rosea. *Cymae* ♂ ter bifurcatae; pedunculus communis 1·2 cm. longus; pedunculi proprii florum 1 mm. longi; pedicelli 7–8 mm. longi. *Perianthii segmenta* exteriora 2, elliptico-oblonga, 1·1 cm. longa, 5·5 mm. lata; segmenta interiora 2, oblanceolato-oblonga, 1·05 cm. longa, 2·7 mm. lata, subacuta. *Androphorum* in toto vix 2 mm. longum, rubrum, parte inferiore stipitiformi 1 mm. longa. *Antherae* 15, inferiores sessiles, 3 superiores filamentis 0·3 mm. longis, 3 mm. longae, connectivo 0·25 mm. ultra loculos producto. *Flores* ♀ solitarii; pedicellus 3·5–4 mm. longus. *Perianthii segmenta* exteriora 2, elliptico-oblonga, 13 mm. longa, 8 mm. lata, extra parce stellato-pilosa; segmenta interiora oblanceolata, 1·2 cm. longa, 4·5 mm. lata. *Ovarium* 1·3–1·5 cm. longum, dense stellato-pubescens, 3-loculare

vel 4-loculare, placentis 2 pro loculo ; styli 3 vel 4, basi 0·5 mm. connati, 2·5–3 mm. longi, aurantiaci (5·5 mm. longi stigmatibus inclusis) ; stigmata 3–3·5 mm. longa, rubra.

Tropical Africa. Congo State. Described from a living plant received from the Botanic Garden, Brussels.

1395. **Vernonia crataegifolia**, *Hutchinson* [Compositae-Vernonieae]; affinis *V. corymbosae*, Less., sed foliis sessilibus vel subsessilibus subtus tenuiter arachnoideo-pubescentibus differt.

Planta 1·25–1·6 m. alta, multicaulis ; caules subteretes, arachnoideo-tomentosi, plerumque dense foliati. *Folia* alterna vel subalterna, sessilia vel subsessilia, elliptica, obovato-oblanceolata vel (in ramulis sterilibus) suborbicularia, basi cuneata, 2·5 9 cm. longa, 1·5–7 cm. lata, membranacea vel tenuiter rigide chartacea, utrinque tenuiter arachnoideo-pubescentia vel fere glabra, subtus glandulis flavis dense instructa, grosse repando-dentata vel subpinnatifida, dentibus plus minusve triangularibus acute mucronatis, nervis lateralibus utrinque 5–6 rectis vel leviter arcuatis infra prominentibus intra marginem conspicue ramosis. *Corymbi* usque ad 15 cm. expansi, foliosi. *Capitula* 4 5-flora, anguste obovoidea vel subcylindrica, circiter 6 mm. diametro, 6–8 mm. longa. *Involucri bracteae* 4-seriatae, ellipticae vel oblongo-ellipticae, apice rotundatae, extra apicem versus pubescentes. *Pappi setae* numerosae, interiores corollae tubo paulo longiores, exteriores multo breviores, omnes minute barbellatae. *Corolla* lilacina (*Pegler*) vel purpurea (*Tyson*) ; tubus 5 mm. longus, medio 0·5 mm. diametro, minute glandulosus ; lobi lanceolato-lineares, subobtusi, 3 mm. longi, vix 0·75 mm. lati, glabri. *Antherae* 2·5 mm. longae. *Stylus* 6 mm. longus, ramis 2 mm. longis. *Achaenia* 2 mm. longa, pilosa, dense glandulosa.— *Vernonia mespilifolia*, E. Meyer in Drège, Zwei Pfl. Documente, 152, 228, non Lessing.

South Africa. Eastern Region : Transkei Div. ; Kentani district, in valleys (April), *Pegler*, 999. Pondoland ; between St. Johns River and Umsikaba River, 305–610 m. (May), *Drege*, *a* and *b*. East Griqualand ; Shawbury (May), *Baur*, 219 ; near Clydesdale (March), *Tyson*, 1188, 1242. Natal ; Tugela River, Colenso, *Rehmann*, 7184 ; and without precise locality, *Gerrard*, 711 ; *Cooper*, 2579. Kalahari Region : Transvaal ; Kaap Valley, Barberton (April), *Galpin*, 1350.

This species is most closely allied to *V. corymbosa*, Less., and *V. mespilifolia*, Less., and it has even been associated with the latter in the Drègean herbarium. From both, however, it may readily be distinguished by its sessile or subsessile, coarsely toothed leaves, and from the former more especially by the loose indumentum on their lower surfaces.

1396. **Maba Dawei**, *Hutchinson* [Ebenaceae] ; affinis *M. natalensi*, Harv., sed foliis leviter emarginatis, floribus pedicellatis in cymis 2–3-floris dispositis differt.

Suffrutex ; rami graciles, flexuosi, teretes, breviter pubescentes ; ramuli floriferi graciles, patuli, pubescentes, internodiis 0·5–1 cm. longis. *Folia* elliptica, ovato-elliptica vel rhomboideo-elliptica, leviter emarginata, basi subcuneata, 1·5–2·5 cm. longa, 0·7–1·5 cm. lata, chartacea, glabra, utrinque subnitida, juniores breviter ciliata, distincte reticulata ; petioli 2 mm. longi, rugulosi, pubescentes.

Cymae ♂ axillares, 2–3-florae; pedunculi circiter 2 mm. longi, breviter pubescentes; pedicelli 1–1·5 mm. longi, glabri vel parce puberuli, apice articulati. *Calyx* campanulatus, truncatus, basi leviter constrictus, 2·5–3 mm. longus, vix 3 mm. diametro, utrinque glaber, parce ciliolatus. *Corolla* triloba; tubus campanulato-obconicus, 2·5 mm. longus; lobi ovato-oblongi, submucronati, circiter 2·5 mm. longi et lati, margine incurva, extra appresse pilosi, intra glabri. *Stamina* circiter 15, basi corollae tubo adnata; filamenta distincta, vix 0·5 mm. longa; antherae 1·75 mm. longae, breviter apiculatae. *Flores* ♀ non visi.

Tropical Africa. Portuguese East Africa: Goruro, in forests (Jan.), *Dawe*, 524.

1397. **Utricularia odontosepala**, *Stapf* [Lentibulariaceae]; affinis *U. Welwitschii*, Oliver, sed sepalis inciso-serratis valde insignis.

Herba gracilis, terrestris, annua. *Rhizoidea* foliaque ignota. *Scapus* filiformis, 10–12 cm. altus, simplex vel parce ramosus. *Flores* valde dissiti, pauci; bracteae subulato-lanceolatae, ad 1 mm. longae; bracteolae iis simillimae; pedicelli brevissimi vel ad 1 mm. longi. *Sepala* ambitu rotundato-ovata, inciso-serrata, dentibus utrinque 3 acutis, 1·5–1·75 mm. longa, flavida. *Corolla* 7–8 mm. longa, violacco-purpurea, palato aureo; labium superum late ovatum, emarginatum, 3 mm. longum; labium inferum vix 4 mm. longum, subrotundum, palato bi-gibboso laevi; calcar gracile, acutum, descendens, vix 1 cm. longum. *Antherae* vix 1 mm. longae. *Pistillum* oblique lageniforme, stylo brevi, stigmatis labiis latis minute papillosis, inferiore prc rata amplo. *Capsula* seminaque ignota.

Tropical Africa. N. W. Rhodesia: Kashitu River, *Rogers*, 8632.

1398. **Graphtophyllum glandulosum**, *Turrill* [Acanthaceae-Acanthoideae]; ab affini *G. picto*, Griff., foliis distincte acuminatis, corollae tubo et calyce glanduloso, staminibus dorso pubescentibus recedit.

Caulis erectus, quadrangularis, parce pubescens vel glaber. *Folia* elliptico-lanceolata, apice acuminata, basi cuneata, usque ad 20 cm. longa et 6 cm. lata, infra minute puberula, supra conspicue cystolithigera, margine integra, nervis lateralibus utrinque circiter 10 in pagina utraque distinctis, petiolis 2 cm. longis suffulta. *Flores* in paniculam terminalem dispositi; bracteae lineares, 2 mm. longae, minute puberulae; bracteolae minutae. *Calyx* quinquepartitus, segmentis lineari bus acutis 3 mm. longis extra glandulosis. *Corollae tubus* inferne cylindricus, superne ampliatus, 2 cm. longus, extra glandulosus; labium posticum breviter bilobatum, 9 mm. longum, 2 mm. latum, anticum tripartitum, segmentis 1 cm. longis 3 mm. latis. *Stamina* 2, filamentis exsertis, 1·5 mm. longis leviter pubescentibus; antherarum loculi 2, aequales, mutici, dorso pubescentes; pollinis granula breviter ellipsoidea, 50 μ longa, 40 μ diametro. *Discus* 1 mm. altus. *Ovarium* 2 mm. altum, 1 mm. diametro, glabrum, loculis 2-ovulatis; stylus 2·5 cm. longus, leviter pubescens.

Tropical Africa. Southern Nigeria: Oban District, *Mr. and Mrs. P. A. Talbot*; Cross River, Ifunkpa-Atakom, *J. H. Holland*, 216. Cameroons: Johann-Albrechtshöhe, forest region, *Staudt*, 455.

1399. **Blepharis Evansii**, *Turrill* [Acanthaceae-Acanthoideae]; *B. madanensi*, S. Moore, affinis, sed floribus minoribus differt.

Rami teretes, albo-pubescentes. *Folia* lineari-lanceolata, sessilia, spinuloso-acuminata, 4–5 cm. longa, 6–8 mm. lata, subcoriacea, utrinque albo-pubescentia, marginibus spinosa. *Inflorescentia* terminalis vel lateralis, congesta, multiflora, albo-pubescens; bracteae steriles lineari-lanceolatae, spinuloso-acuminatae, 1·2 cm. longae, 4 mm. latae, pubescentes, fere integrae, fertiles bracteolaeque lineares, spinuloso-acuminatae, 2 cm. longae, 4 mm. latae, albo-pubescentes, marginibus spinulosae. *Calycis* lobi 4; anticus oblongo-lanceolatus, apice bilobatus, quinquedentato-spinulosus, 1·7 cm. longus, 6 mm. latus, pubescens; posticus oblongo-lanceolatus, apice tridentatus, 2·2 cm. longus, 6 mm. latus, pubescens; laterales lineares, apice spinuloso-acuminati, 1·7 cm. longi, 2 mm. lati, pubescentes. *Corollae* tubus 1 cm. longus, glaber; limbus trilobatus, lobo intermedio minore, 1·7 cm. longus, 1 cm. latus, pubescens, caeruleus. *Stamina* 4, filamentis 5 mm. longis glabris; antherae 5 mm. longae, staminum anticorum lobis fertilibus quam sterilibus tertia parte longioribus; pollinis granula longe ellipsoidea, circiter 40 μ longa, 25 μ diametro. *Ovarium* 3 mm. altum, 1·5 mm. diametro, glabrum; stylus 1·3 cm. longus, glaber, breviter aequaliterque bifidus.

Tropical Africa. British East Africa: Guasa Nyiro; "among quartz," Lion Camp, *Maurice S. Evans*, 754.

1400. **Cleistanthus gabonensis**, *Hutchinson* [Euphorbiaceae-Phyllantheae]; affinis *C. bipindensi*, Pax, sed floribus subsessilibus, discis minoribus et tenuioribus, staminibus numerosioribus, antheris majoribus subsessilibus differt.

Arbor 6–10 m. alta; rami breviter pubescentes; ramuli juniores patuli, angulares, pubescentes vel demum fere glabri. *Folia* oblonga vel oblongo-elliptica, subacute caudato-acuminata, acumine circiter 1·2 cm. longo, basi rotundata, 5·5–11 cm. longa, 3–5 cm. lata, chartacea vel tenuiter coriacea, saepe supra glauca, subtus pallide viridia, utrinque glabra et opaca, nervis lateralibus utrinque 4–6 arcuatis, nervis tertiariis gracilibus subparallelis crebris distinctis; petioli circiter 4 mm. longi, transverse rugosi, breviter pubescentes; stipula non visae. *Flores* monoici, axillares, 3–4-fasciculati, ♀ solitarii, ceteri ♂, omnes subsessiles. *Flores* ♂: *Sepala* ovato-lanceolata, subobtusa, 5 mm. longa, 2 mm. lata, extra dense rufo-tomentella, intra glabra. *Petala* oblanceolata, subacuta, 1·5 mm. longa, carnosa, glabra. *Discus* parvus, carnosus, pubescens. *Stamina* 7–10; filamenta brevissima; antherae 2·5 mm. longae, glabrae. *Ovarii rudimentum* dense rufo-villosum. *Flores* ♀: *Sepala* et petala ut in floribus ♂. *Discus* tenuis, margine et intra longe villosus. *Ovarium* dense rufo-villosum; styli tomentosi, multifidi. *Capsula* triloba, circiter 1·2 cm. longa, 2 cm. diametro, dense rufo-villosa et crispe pubescentia. *Semina* 7 mm. longa, nitidula.

Tropical Africa. Gaboon: neighbourhood of Libreville, *Klaine*, 3422, 3432.

This species is remarkably similar to *C. bipindensis*, Pax, from which it can scarcely be separated except by dissection and comparison of the flowers. It differs in its subsessile flowers, smaller and thinner male and female disks, more numerous stamens, and larger, subsessile anthers.

1401. **Drypetes aframensis**, *Hutchinson* in Dyer, Fl. Trop. Afr., vol. vi., sect. i., p. 682, *anglice* [Euphorbiaceae-Phyllantheae]; *D. leonensi*, Pax, facie similis sed staminibus numerosioribus differt.

Arbor circiter 14 m. alta; ramuli leviter sulcati, glabri. *Folia* elliptica vel oblongo-elliptica, brevissime et paulo abrupte acuminata, basi cuneata et leviter inaequalia, 5–10 cm. longa, 2·5–4·5 cm. lata, rigide chartacea, utrinque glabra et opaca vel nitidula, nervis lateralibus utrinque circiter 7 intra marginem anastomosantibus utrinque distinctis subtus leviter elevatis; petioli 3–4 mm. longi, leviter rugosi, glabri; stipulae parvae, coriaceae, caducae. *Flores* ♂ axillares, in ramulis junioribus fasciculati; pedicelli 3–4 mm. longi, glabri. *Sepala* 4, obovata vel oblongo-obovata, obtusa, 2·5 mm. longa, 1·5 mm. lata, apice pubescentia, membranacea. *Stamina* 8; filamenta gracilia, glabra; antherae parvae, glabrae. *Discus* magnus, cupularis, glaber, margine irregulariter dentatus. *Flores* ♀ non visi.

Tropical Africa. Upper Guinea: Gold Coast; Afram Plains, *W. H. Johnson*, 714.

1402. **Drypetes Paxii**, *Hutchinson* in Dyer Fl. Trop. Afr., vol. vi. sect. i, p. 681, *anglice* [Euphorbiaceae-Phyllantheae]; affinis *D. bipindensi*, Hutchinson (*Cyclostemon bipindensis*, Pax), sed stipulis multo minoribus staminibus 4 facile distinguenda.

Ramuli graciles, sulcati, minute puberuli. *Folia* oblonga vel oblongo-elliptica, caudato-acuminata, basi subcuneata et leviter inaequalia, 7·5–11·5 cm. longa, 4–4·5 cm. lata, tenuiter chartacea vel submembranacea, integra, utrinque glabra, supra nitida, nervis lateralibus utrinque 10–11, pergracilibus patulis intra marginem anastomosantibus, venis et venulis leviter prominentibus; petioli graciles, 4–6 mm. longi, densiuscule puberuli; stipulae deciduae, parvae. *Flores* ♂ axillares, in ramulis foliosis fasciculati; pedicelli graciles, 3 mm. longi, dense puberuli. *Sepala* 4, oblonga, obtusa, 2 mm. longa, 1 mm. lata, utrinque puberula, ciliata. *Stamina* 4; filamenta gracilia, basin versus gradatim latiora, glabra; antherae oblongo-ellipsoideae, 0·35 mm. longae. *Discus* cupularis, tenuis, dentatus, intra pubescens, extra glaber. *Flores* ♀ non visi.

Tropical Africa. Upper Guinea: Cameroons; Bipinde, *Zenker*, 3788.

1403. **Drypetes similis**, *Hutchinson* in Dyer, Fl. Afr. Trop., vol. vi. sect. i, p. 679, *anglice* [Euphorbiaceae-Phyllantheae]; affinis *D. glomeratae*, Hutchinson (*Cyclostemon glomeratus*, Muell. Arg.), sed floribus pedicellatis, sepalis extra glabris differt.

Arbor; ramuli teretes, cortice cinereo glabro obtecti. *Folia* magna, oblongo-elliptica, breviter acuminata, basi cuneata vel subobtusa, 30–35 cm. longa, 9–13 cm. lata, coriacea, utrinque glabra et nitida, nervis lateralibus utrinque 8–9 patulis vel ascendentibus prope marginem anastomosantibus supra leviter insculptis subtus prominentibus, venis laxis subtus leviter elevatis; petioli crassi, 1·3 cm. longi, glabri; stipulae subpersistentes, lanceolatae, obtusae, 0·8–1·2 cm. longae, crassae, interdum fere subteretes, glabrae. *Flores* ♂ versus basin ramulorum dispositi; pedicelli circiter 4 mm. longi, robusti, angulares vel sulcati, glabri. *Sepala* 5, rarius 4, oblongo-oblanceolata, vix 4 mm. longa,

1·5 mm. lata, superne dentata, coriacea, glabra. *Stamina* 4 vel 5, circum disco inserta ; filamenta crassa, glabra ; antherae rotundatae, 1·5 mm. longae. *Discus* patelliformis, crassus, undulatus, glaber. *Flores* ♀ pauci, apices ramulorum versus dispositi ; pedicelli robusti, fructiferi demum circiter 1·3 cm. longi, glabri. *Discus* crassus, annularis, glaber. *Ovarium* ellipsoideum, glabrum ; styli breves ; stigma rotundatum, integrum. *Fructus* ellipsoidei, circiter 1·3 cm. longi, 1 cm. diametro. *Semina* matura non visa.

Tropical Africa. Upper Guinea : Cameroons ; Bipinde, *Zenker*, 3194, 3527, 3721. Ilendi, *Ledermann*, 654.

1404. **Tragia (Tagira) affinis**, *Muell. Arg. MSS. in Herb. Holm.* [Euphorbiaceae-Crotoneae] ; species *T. rupestri*, Sond., quam maxime affinis sed foliis minoribus glabratis basi haud 3–lobis capsulisque minoribus apte distinguenda.

Herba, caules elongati, graciles, prostrati vel volubiles, ramosi ; rami puberuli parce pilis urentibus armati. *Folia* breve petiolata, membranacea, triangulari-ovata, acuta, basi breve cordata sinu latiore, margine crebre dentata, utrinque pilis urentibus perpaucis secus nervos obsita ceterum glabra, 2–3 cm. longa, 1–1·5 cm. lata ; petioli puberuli et pilis urentibus perpaucis onusti, 7–9 mm. longi ; stipulae lanceolatae, reflexae, 2–3 mm. longae, glabrae. *Racemi* terminales oppositi foliique, graciles, densi, 3–5 cm. longi, pedunculo nudo gracile puberulo et parce pilis urentibus obsito 1 cm. longo suffulti, flores masculos versus apicem plurimos femineosque 1–2 basales gerentes ; pedicelli sub quaque bractea singuli, maris 1–2 mm. longi, glabri, bracteis breviores ; bracteae maris lanceolatae, 2 mm. longae, margine minute ciliolatae ; bracteae feminei ovatae acute margine dentatae, bracteolae lanceolatae. ♂ *Sepala* 3, ovata, acuta, glabra. *Stamina* 3, filamenta antheris subaequilonga apice incurva. ♀ *Sepala* saepissima 3, nonnunquam 4, ambitu suborbicularia, membranacea, demum accrescentia vix tamen coriacea 6 mm. longa, margine palmatim utrinsecus 4–5-lobulata, extra parce pubescentia. *Ovarium* dense setosum ; styli 3, basi breviter connati, apice recurvi. *Capsula* 3-cocca, parcius pilosa, 6 mm. lata ; cocci subglobosi. *Semina* globosa, brunnea.— *T. rupestris*, β, *glabrata*, Sond. in Linnaea xxiii. 108 ; Muell. Arg. in DC. Prodr. xv. 2, 940 ; *T. rupestris*, γ, *minor*, Muell. Arg. in DC. Prodr. xv. 2, 940 partly and as to Wahlberg's specimen only ; not *T. minor*, Sond.

South Africa. Kalahari Region : Transvaal ; Vaal River, *Zeyher*, 1526 ; *Burke* ; Crocodile River, *Burke* ; without precise locality, *Wahlberg*.

This species is very nearly related to *T. rupestris*, Sond., with which indeed it has been united by Sonder, and bears to this species something like the relationship that *T. durbanensis*, O. Kuntze (*T. Meyeriana*, β, *glabrata* Muell. Arg.), bears to *T. Meyeriana* (*T. Meyeriana*, α, *hirsuta*, Muell. Arg. = *T. Bolusii*, O. Kuntze). In the case of the two last-mentioned plants it is found, now that ample material of both is available, that we have to deal with two readily distinguishable species. The material of the species now described is less ample and, with the specimens at his disposal, the conclusion arrived at by Sonder was not unnatural. But in addition to the material collected by Zeyher and Burke

there are in the Stockholm Herbarium certain specimens, agreeing with the ones named by Sonder, collected by Wahlberg; these have been kindly placed at our disposal for study by Dr. C. A. M. Lindman. Wahlberg's specimens have also been examined by Mueller, and in dealing with them that author has practically recognised the fact that this plant is not referable to *T. rupestris*, Sond. One of them he has named *T. rupestris*, γ, *minor*, and has cited it under this name in the *Prodromus*. Another, evidently part of the same gathering, Mueller has written up as *Tragia* (*Tagira*) *affinis*, Muell. Arg. This latter name has never been taken up, and we are therefore fortunately able to conserve it in connection with a plant which, now that there is ample material of *T. rupestris*, Sond. at our command, is seen to be distinct from Sonder's type of that species.

1405. **Tragia (Tagira) collina**, *Prain* [Euphorbiaceae-Crotoneae]; species *T. incisifoliae*, Prain, habitu congruens sed foliis minus incisis, calyce feminco 3-partito, coccis dorso parum angulatis differt.

Herba caulibus brevibus herbaceis e basi lignoso simplicibus vel parce ramosis, 10–15 cm. altis, parce vel distincte pubescentibus, aculeisque paucis armatis .. *Folia* fere sessilia, membranacea, oblonga, obtusa, basi late cuneata vel truncata, margine basi integra, secus latera parce dentata dentibus nonnunquam obsoletis, apice grosse 3–5-dentata, 0·8–1·2 cm. longa, 6–8 mm. lata, utrinque secus nervos parce hirsuta aculeataque; petiolus 1–2 mm. longus, hirsutus aculeatusque; stipulae patentes lanceolatae, hirsutae, 3 mm. longae. *Racemi* oppositifolii subterminales 2·5–5 cm. longi, pedunculis dense pubescentibus 0·5–1 cm. longis suffulti, floribus masculis pluribus femineisque basalibus 1–3 onusti; pedicelli utriusque sexus sub quaque bractea solitarii eaque breviores; bracteae bracteolaeque lanceolatae, integrae, subglabrae, bracteae maris 3 mm. longae, feminei 4 mm. longae. *Sepala* maris 3, ovata, apiculata, extra puberula. *Stamina* 3, erecta, filamentis basi incrassatis antheris longioribus. *Sepala* feminei 3, accrescentia, subcoriacea, suborbicularia, utrinsecus pinnatim 5–6-lobulata, extra pubescens intus glabra; lobuli lanceolati, rhachidis diametro aequilongi. *Ovarium* dense setosum; styli 3, inferne in columnam glabram connati, dimidio superiore liberi, recurvi. *Capsula* 3-cocca, parce setosa, 8 mm. lata; cocci dorso parum angulati. *Semina* globosa.

South Africa. Natal: near Colenso, 1370 m., *Schlechter*, 3381; near Pieters, 915–1220 m., *Wood*, 8881.

A very distinct species, with the habit of *T. incisifolia* but with different leaves. As regards its flowers and fruits it most nearly approaches *T. angustifolia*, Benth. and *T. Kirkiana*, Muell. Arg. The flowers are stated by Mr. Medley Wood to be pink.

1406. **Tragia (Agirta) cocculifolia**, *Prain* [Euphorbiaceae-Crotoneae]; species *T. imerinicae*, Prain, proxima sed foliis majoribus densius strigosis haud aculeatis racemisque 1–sexualibus apte distinguenda.

Frutex ramis suberectis lignosis strictis vel subvolubilibus, dense pubescentibus, ramulis brevibus pilis retrorsis dense pubescentibus. *Folia* breve petiolata, membranacea, late oblonga vel ovata vel suborbicularia, obtusa vel acuta, basi parum cordata, margine

integra vel subundulata, 4–6 cm. longa, 2–4·5 cm. lata, utrinque distincte reticulata et secus nervos pilis patentibus elongatis densius strigosa nec tamen aculeata ; petiolus patenter pubescens, 1·5–2·5 cm. longus ; stipulae falcatae, erectae, acutae, 4 mm. longae, glabratae. *Racemi* (masculi tantum visi) terminales, 4–5 cm. longi, pedunculo dense pubescente perbrevi suffulti ; bracteae nisi ima lineari-spathulatae, acutae, subcucullatae, 2 mm. longae glomerulos 3-flores subtendentes, bractea ima fere basalis foliacea, suborbicularis, 5–7 mm. diametro, flos singulum masculum ceteris paullo majorem subtendens. *Sepala* maris saepius 3, nonnunquam 4, suborbicularia, obtusa, extra strigosa. *Stamina* 3, raro 4, centrum floris occupantia ; antherae sub anthesin reflexae, horizontales. *Flos femineus* haud visus.

Madagascar. Central Madagascar, *Baron*, 1748, 3951.

Very similar to *T. imerinica*, but the leaves are less prominently reticulate, densely strigose but not at all aculeate, do not become so firmly papery when full grown, and are of larger size. Almost at the base of the racemes, in place of some distance above the base, occur large bracts (reduced leaves) exactly like the female bracts of *T. imerinica*. These leafy bracts, however, in place of subtending a glomerulus of female flowers as in *T. imerinica*, subtend solitary male flowers with longer pedicels and of larger size than the male flowers in the glomerules which occupy the remainder of the raceme.

1407. **Tragia (Agirta) imerinica**, *Prain* [Euphorbiaceae-Crotoneae] ; species *T. Boivinianae*, Mucll.-Arg., affinis sed foliis minoribus et bracteis flores femineos subtendentibus latissimis foliaceis suborbicularibus vel subreniformibus differt.

Frutex ramis suberectis lignosis parce pubescentibus vel glabris, ramulis parce puberulis strictis vel raro volubilibus. *Folia* breve petiolata, membranacea demum papyracea, triangulari-ovata, acuta vel obtusa, mucronulata, basi parum cordata vel truncata, margine distanter minutissime glanduloso-denticulata, 2·5–3 cm. longa, 1·5–2·5 cm. lata, utrinque secus nervos parce aculeis albidis obsita, adulta prominenter reticulata, minutissime puncticulata ; petiolus pubescens 1–1·25 cm. longus ; stipulae oblongae, erectae, subacutae, 2 mm. longae. *Racemi* terminales, 4–5 cm. longi, pedunculo parcissime puberulo 1-2 cm. longo suffulti, supra flores masculos prope basin flores femineos gerentes ; bracteae maris lineari-lanceolatae, patentes, 1 mm. longae, inferiores cymulas 2–3–floras, superiores flores singulos pedicellis medio bracteolatis suffultos subtendentes ; bracteae feminei foliaceae, suborbiculares vel reniformes, 5–7 mm. longae 5–9 mm. latae, flores sessiles 2–3 subtendentes. *Sepala* maris saepius 3, nonnunquam 4, suborbicularia, subacuta, extra puberula. *Stamina* 3, raro 4, centrum floris occupantia ; antherae sub anthesin reflexae, horizontales. *Sepala* floris feminei 6, lanceolata, acuta, extra pubescentia, sub anthesin ovario absque stylo aequilonga. *Ovarium* dense velutinum ; styli 3, dimidio inferiore in columnam connati. *Capsula* juvenilis tantum obvia, glabra.

Madagascar. Central Madagascar, *Baron*, 2872. North-West Madagascar, *Baron*, 4989.

A very distinct species. The leaves in texture closely resemble those of *T.* (*Agirta*) *Boiviniana*, Muell. Arg., but are much smaller, have a different outline and relatively longer petioles. *T. imerinica* agrees with *T. Boiviniana* in having glomerulate female flowers, but the female calyx-segments are much smaller than in *T. Boiviniana*. The most striking differential character is, however, to be met with in the bracts subtending the female flowers which in *T. Boiviniana* are like the male bracts but in *T. imerinica* are like much reduced leaves.

1408. **Tragia (Tagira) Sonderi**, *Prain* [Euphorbiaceae-Crotonae]; species quoad folia magis *T. Dinteri*, Pax, accedens, differt tamen racemis masculis multo longioribus, bracteis majoribus, caulibus volubilibus.

Herba caulibus e basi ligroso suberectis demum volubilibus, metralibus, parce ramosis, parce pubescentibus et plus minusve pilis urentibus armatis. *Folia* longe petiolata, membranacea, triangulari-ovata, acuta, basi cordata, margine grosse dentata vel duplicato-dentata, 4–7·5 cm. longa, 2·5–6·5 cm. lata, utrinque parce pubescentia et secus nervos plus minusve setosa; petiolus minute puberulus et parce setosus, 2·5–6 cm. longus; stipulae lanceolatae, reflexae, glabrae, 4 mm. longae. *Racemi* laterales, oppositifolii, 1–sexuales, masculi 7·5–10 cm. longi, floribus plurimis dissitiusculis onusti, pedunculisque 1–1·5 cm. longis suffulti; flores inferiores in cymulas 3-floras aggregati, superiores subquaque bractea solitarii sed pedicellis basi iterumque medio 2-bracteolatis; bracteae linearis-lanceolatae, reflexae, 3 mm. longae. *Sepala* maris 3, lutea, ovata apiculata, glabra. *Stamina* 3; filamenta antheris longiora; antherae subconniventes. *Flores feminei fructusque* adhuc ignoti.

South Africa. Transvaal: Macalisberg, *Zeyher*; *Burke*. Swaziland: High Veld at Dalriach; near 'Mbabane, 1350 m., *Bolus*, 12,290.

A very distinct species with leaves like those of the German South-West African *T. Dinteri*, Pax, but with different habit and different male flowers. The original specimens were too imperfect for description, yet, imperfect as they were, they made it clear to Dr. Sonder that they represented a species of *Tragia* quite distinct from any of the ones described by him.

1409. **Leidesia firmula**, *Prain* [Euphorbiaceae-Crotoneae]; species ab alteris hujus generis caulibus ramisque firmulis nec succulentis, foliisque lanceolatis haud puncticulatis facile distinguenda.

Herba erecta, basi lignosa, intricatim ramosa, comam 15 cm. altam 18 cm. diametro efficiens. *Folia* breve petiolata, membranacea, ovato-lanceolata vel lanceolata, acuta, basi anguste cuneata, margine pubescente crebre minuteque crenulata, 1·2–1·8 cm. longa, 4–6 mm. lata, nisi margine ubique glabra; petiolus 2·5–3 mm. longus, glaber; stipulae lanceolatae, glabrae, 1 mm. longae. *Racemi* androgyni, superne florum masculorum glomerulos dissitos, ad basin florum femineorum glomerulum pauciflorum singulum gerentes; bracteae masculae ovatae, acutae, bracteolae oblongae, acutae, omnes margine et extra parce ciliatae; pedicelli maris calyce longiores, feminei capsula parum breviores, omnes articulati. *Calyx* maris

alte 3-partitus ; lobi ovati, acuti, extra parce ciliati. *Stamina* 3–4. *Capsula* 2-dyma ; cocci extra hispiduli, 2 mm. longi ; stigmata persistentia vel subpersistentia, simplicia, papillosa.

South Africa. German South-West Africa : Great Namaqualand ; Gamokab, *Schinz*, 898 ; Karukab, *Schinz*, 899 ; Groot Fontein, *Dinter*, 700.

1410. **Adenocline stricta**, *Prain* [Euphorbiaceae-Crotoneae]; species *A. ovalifoliae*, Turcz., quam maxime affinis sed caulibus rigidis internodiis abbreviatis foliisque sessilibus cum stipulis foliaceis basi confluentibus facillime distinguenda.

Herba dioica ; caules erecti, basi lignosi superne stricte virgatim ramosi, 20–22 cm. alti, internodi 0·8–1·2 cm. longi. *Folia* alterna, sessilia, firme membranacea, oblonga vel oblongo-lanceolata, acuta, basi lata ibique stipulis confluentia, margine argute serrata, 0·8–1·2 cm. longa, 5–6 mm. lata ; stipulae foliaceae foliis ipsis parum minores 5–8 mm. longae, 4–5 mm. latae. *Flores* masculi nondum visi ; feminei solitares, oppositifolii, pedicellati, pedicellis abrupte reflexis. *Calyx* alte 5-fidus ; segmenta lanceolata, margine serrata, reflexa. *Ovarium* glabrum. *Capsula* 3 mm. lata, 3-dyma, laevis.

South Africa. Coast Region : Bredasdorp Div. ; Riet Fontein Poort, near Elim, 30–60 m., *Bolus*, 8603 ; *Schlechter*, 9694.

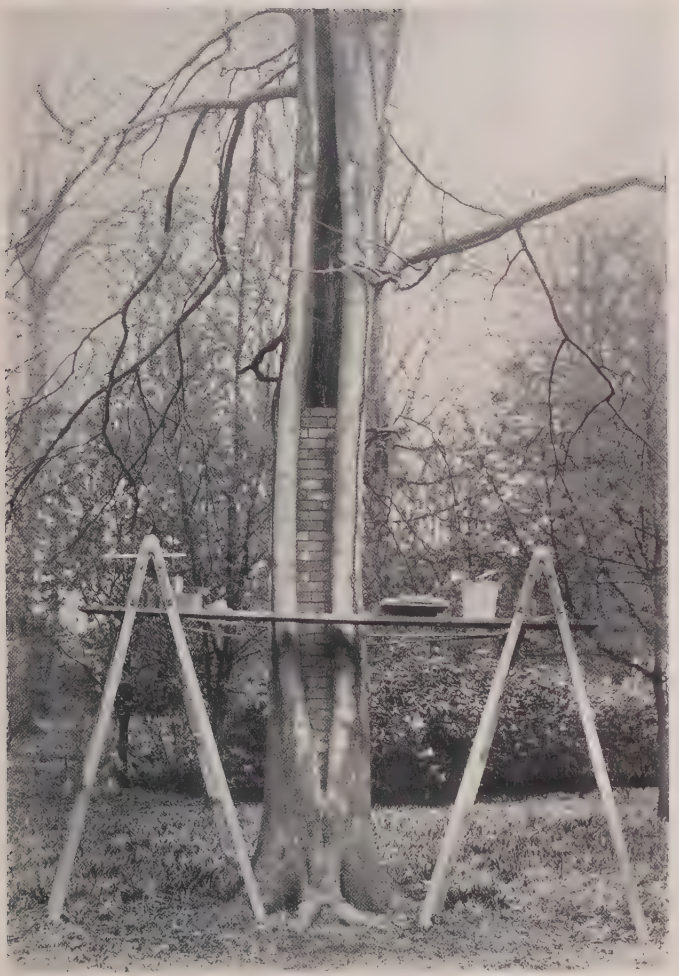
XLI.—HOLLOW TREES.

W. J. Bean.

There is no doubt that hollow places in the trunks and limbs of trees formed by decay are better filled up. If the cavity be a large one the appearance of the trunk is thereby improved, and if it be small and properly treated decay is often arrested and new bark encouraged to grow over the filled up cavity. It prevents the entrance and accumulation of moisture, and thereby removes one of the chief predisposing conditions of decay.

The majority of such decayed hollows have their origin in snags left by branches broken off that have rotted back into the trunk because the new bark has not been able to grow over and seal up the wound. Branches removed by design, or broken off by wind or accident, should always be sawn off close to the trunk, and the sawn surface should then be coated over with ordinary coal tar. If a snag or stump is left the bark cannot grow over it ; damp, fungoid parasites and decay sooner or later follow and gradually find their their way towards and eventually into the trunk. Such is the most frequent beginning of cavities in the limbs and trunks of trees. The coating of tar renewed every two or three years, makes the wound watertight and fungus-proof ; its object being to serve as a temporary bark until a new natural covering is formed. It is certain that the life of many trees, historically famous or otherwise notable, might be much prolonged if a close watch against the intrusion of decay into the trunks and main branches was maintained.

With regard to hollows that have already formed the following treatment is recommended :—First clean out all the decayed material, especially the soft brown crumbling wood and the soppy



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mass frequently found at the bottom. Sound dead wood that has become dry and hard does not matter. Then wash the surface of the wood that is left exposed with a strong solution of carbolic acid. After allowing this a day or two to dry, a good thick coating of ordinary tar should be laid on. This antiseptic treatment is intended to destroy as far as possible fungoid parasites. It now remains to fill up the cavity. If this be a small one Portland cement may be used, and for round holes like those made by woodpeckers a plug of oak cut to fit will do. But if the hollow be a large one, like that shown in the illustration, the aid of the bricklayer may be obtained. After the bricks are laid the whole should be surfaced with cement. In the case of black trunks lampblack may be mixed with the outer layer of cement or it may be dusted over thickly with soot whilst wet. An intelligent workmen may be able also to imitate the characteristic corrugations or markings of the trunk.

These, however, are mere refinements. The chief points are, the keeping out of moisture and the provision of a surface over which the new bark may grow. If a tree is in a state of vigorous growth, as many hollow trees are, the bark will in time close over the "stopping." But unless some surface is provided on which the new wood can set itself it forms the thickened rolls seen in the beech tree of the picture. In very hollow trees open on one side a curious spiral growth of wood is sometimes seen in place of these thickened rolls which is due to the new wood continually being deposited on its own inner surface. A remarkable example of this curious growth is exhibited in No. IV. Museum at Kew, presented by Lord Iveagh. It is a section of elm trunk that was so hollow as to be merely a shell a few inches thick. On one side of the trunk was a longitudinal slit. The tree appears to have a good growth and to have made vigorous efforts to close up the opening, but having no surface on which to deposit the new wood and bark and thus bridge over the gap between the two lips, it eventually formed by its continual growth on the inner side two remarkable spirals suggesting a pair of scrolls.

XLII.—DECADES KEWENSES.

Plantarum Novarum in Herbario Horti Regii.

DECAS LXVI.

651. **Mahonia confusa,** *Sprague* [Berberidaceae]; affinis *M. Fortunei*, Fedde, a qua rhachi supra jugum supremum foliolorum producta, foliolis latioribus numerosioribus differt.

Planta circiter 1·2 m. alta. *Caulis* nitidulus, superne in sicco 5–6 mm. diametro; internodia superiora 0·8–1·3 cm. longa. *Folia* 26–40 cm. longa; petioli leviter vaginantes, 0·8–2·3 cm. longi; foliola 6–9-juga, lanceolata vel oblongo-lanceolata, longe acuminata, spinuloso-terminata, in inferiore $\frac{1}{3}$–$\frac{2}{5}$ versus basin angustata, integra, abhinc usque ad apicem grosse spinuloso-dentata dentibus utrinque 3–6; foliolum terminale 7·5–11 cm. longum, 1·5–3 cm. latum, basi 5-nervium nervis ad $\frac{2}{3}$ anastomosantibus; foliola lateralia intermedia

6–10 cm. longa, 1·5–2 cm. lata, basi trinervia ; foliola infima stipulis quam maxime approximata, circiter 3·5 cm. longa ; stipulae patentes, anguste subulatae, 0·8–1·5 cm. longae. *Racemi* 4–7, circiter 9 cm. longi ; bracteae cymbiformes, leviter deflexae, 3·5 mm. longae ; pedicelli circiter 2 mm. longi. *Sepala* exteriora circiter 2 mm. longa, media et interiora circiter 4·5 mm. longa, medio 5–7-nervia. *Petala* obovata, trinervia, 3·5 mm. longa. *Stamina* 2·5 mm. longa ; filamenta 1·5 mm. longa, edentula. *Ovula* 2, collateralia. *Bacca* caerulescenti-nigra, disperma, in sicco 7–8 mm. longa. *Semina* compresso-pyriformia, circiter 7 mm. longa. *Mahonia Fortunei*, Fedde in Engl. Jahrb. vol. xxxi. p. 130, quoad *Henry* 3117, non *Berberis Fortunei*, Lindl.

China. Hupeh : Ichang, *Henry*, 3117, 3351a. Western Hupeh, *Wilson*, 2680. Szechuan : Mt. Omi, *Wilson*, 3143.

Mahonia Fortunei, Fedde, has leaves with 3–6 pairs of narrow leaflets, the terminal leaflet being inserted between the uppermost pair. *Mahonia confusa* has 6–9 pairs of leaflets, and the terminal leaflet is separated from the uppermost pair by an internode of the rhachis. It is singular that the two species should have been confused, since the insertion of the terminal leaflet has been used in the key to the species given by Fedde in Engl. Jahrb. vol. xxxi. p. 79.

652. **Crotalaria** (Calycinae) **Meeboldii**, *Dunn* [Leguminosae-Genisteae] ; affinis *C. capitatae*, Benth., foliis oblongis basi rotundatis nec oblanceolatis basi cuneatis differt.

Herba perennis, 1·2 m. alta, rhizomate lignoso. *Caules* pauci, apice ramis brevibus florigeris muniti, inferne sub anthesi nudi, molliter (praesertim supra) hirsuti. *Folia* anguste oblongo-linearia, apice basique acuta vel obtusa, apiculata, 4–6 cm. longa, brevissime petiolata, margine paullo revoluta, integra, chartacea, supra praeter costam glabra, subtus et in margine pilis longis sparsis vestita ; stipulae lineares, deciduae. *Inflorescentia* 50 cm. longa, 6–8 cm. lata. *Racemi* densi, 3–4 cm. longi, in ramis 8–10 cm. longis basi paucifoliatis. *Flores* subsessiles, bracteolis linearibus. *Calyx* bilabiatus, extus dense et longe villosus, 1·3 cm. longus, lobis linearilanceolatis acutis tubo bis longioribus. *Corolla* caerulea, calyce vix longior ; vexilli lamina rotundata, basi squamis 2 deflexis instructa, apice extus parce sericea, ungue basi linea arcuata albo-tomentosa ornato ; alae oblongae, transverse rugosae ; petala carinae margine antica albo-tomentosa. *Ovarium* sessile, glabrum. *Legumen* calyci aequilongum.

India. Assam : Naga Hills ; Shibong, 900 m., *Meebold*, 7548.

653. **Begonia** (Hydristyles) **Cuninghamei**, *Sprague* [Begoniaceae] ; affinis *B. Bridgesii*, A. DC., a qua foliis majoribus longius petiolatis distinguitur.

Herba 5 dm. alta, radice fibroso. Caulis fere e basi ramosus, erectus, teres, laevis, glaber, inferne circiter 8 mm. diametro sordide rubellus, superne viridulus ; internodia 6–9 cm. longa. *Folia* oblique elliptico-ovata, sat abrupte acute acuminata, apice subrecurva, basi inaequaliter cordata, juniora utrinque praesertim supra nitida, supra impresso-punctata, adulta 12–16 cm. longa, 6·5–9·5 cm. lata, basi palmatim 10–11-nervia, margine leviter recurvo setuloso-serrulato, serrulis aliis apicem folii aliis basin folii spectantibus,

supra concava, opaca, viridia, nervis leviter impressis inconspicuis, subtus convexa nervis mesophylloque contiguo necnon venulis plus minus sanguineis, ceterum pallide viridia, subtiliter albido-punctata; petioli 3–7 cm. longi, nitiduli, leviter rubelli; stipulae oblongae, 2–3 cm. longae, apice rotundatae, apiculatae, basi truncatae postice plus minus cuspidatae, juventute postice circa caulem connatae, antice liberae, arcte imbricatae, membranaceae, pallide virides, nonnunquam leviter sanguineo-tinctae. *Cymae* unisexuales; pedunculus 8–12 cm. longus, glaber, rubellus; bracteae late ellipticae, circiter 7 mm. longae, inconspicue ciliatae vel denticulatae, membranaceae, caducae. *Flores* albi vel plus minus roseo-tincti. *Cymae* ♂ ter bifurcatae, deinde monochasiales. *Perianthii segmenta* 2, late ovata, basi subcordata, apice rotundata, circiter 1 cm. diametro. *Stamina* circiter 60, toro brevi insidentia; filamenta inaequalia, 1–2 mm. longa; antherae obovato-oblongae, 1–1·3 mm. longae, connectivo maximo apice rotundato loculos 0·2–0·4 mm. superante, loculis lateralibus 0·7–0·8 mm. longis. *Cymae* ♀ ter vel quater bifurcatae, deinde monochasiales. *Perianthii segmenta* 5, elliptico-oblonga vel ovato-elliptica, exteriora circiter 1·1 cm. longa, 7·5 mm. lata, interiora minora, intimum saepe minimum. *Ovarium* triloculare, trialatum, alis 2 subaequalibus cum ovarii lobis elliptico-oblongis, ala tertia majore cum ovarii lobo oblique ovata 1·3–1·7 cm. longa; placentae bipartitae, utrinque ovuliferae; styli 3 ima basi connati, 1 mm. supra basin bifidae vel trifidae, cruribus circiter 1 mm. supra basin in ramos stigmaticos spirales plus minusve inaequales bifidis, fasciis papillarum basi extra continuis.

S. America. Bolivia: on the slopes of the Andes, 14° 30′ S., 540 m. alt. Described from a living plant raised from seeds received in 1911 from Mr. H. Clinton Baker of Bayfordbury, Hertford. The seeds were collected by Mr. *L. Cuninghame*.

654. **Gentiana minuta**, *N. E. Brown* [Gentianaceae-Swertieae]; affinis *G. infelici*, Clarke, sed multo minor, floribus plus quam duplo brevioribus, corolla 5-loba.

Herba perennis, 1 cm. alta. *Rami* radiato-decumbentes, 1–2 cm. longi, glabri. *Folia* sessilia, omnia caulina, patula, 2–3 mm. longa, 1–1·5 mm. lata, lanceolata vel ovato-lanceolata, subobtusa, glabra. *Flores* solitarii, terminales, sessiles, 4·5 mm. longi. *Calyx* 5-lobus, glaber; tubus 2 mm. longus, 2·5 mm. diametro, campanulatus; lobi recurvi, 1–1·3 mm. longi et lati, ovati, acuti. *Corolla* cylindrico-campanulata, 5-loba, glabra, fauce squamis coronata; tubus 3 mm. longus; lobi 1·5 mm. longi et lati, suborbiculati, apice rotundati; squamae 1 mm. longae, lanceolatae, acutae.

India. Himalaya: at Tunkra Pass, August, *Hooker fil.* and *Thomson*.

This is one of the smallest species of the genus, and was found mixed in moss with a species of *Sedum*.

655. **Polygonum (Cephalophilon) palmatum**, *Dunn* [Polygonaceae]; ab omnibus ceteris hujus sectionis foliis palmatis distincta.

Herba elata, robusta, caule terete striato ut ramulis petiolis venisque foliorum supra et subtus ut pedunculis bracteisque florum tomento sparso stellato et pilis strigosis vestito. *Folia* praeter suprema palmata, circumscriptione rotundata, cordata, dimidio vel

altius in lobos 5–7 incisa, ad 25 cm. longa, papyracea, lobis ovatis acuminatis basi contractis, sinubus rotundatis; petioli foliis aequilongi vel longiores; ocreae ovatae, acuminatae, laxae, eciliatae. *Racemi* capituliformes, globulares, 0·8–1 cm. longi, in ramis longis gracilibus paniculi terminalis instructi. *Flores* congesti, sub bractea quaque terni, 2–3 mm. longi, bracteolis 4 suffulti; bracteae flores excedentes, lineares, basi paullo expansi, decurrentes sed non tubulares; bracteolae ovatae, praeter cilias in margine paucas glabrae, floribus brevioribus. *Perianthium* 5-lobum, lobis lanceolatis tubo paullo brevioribus. *Stamina* 10, in tubo inserta. *Ovarium* ovale; stigmata 3. *Nux* trigona, 2 mm. longa, perianthio persistente brevior.

India. Assam: Manipur; Barak, 1200–1500 m. *Meebold*, 5730; Jhirighat, *Meebold*, 4790.

656. **Helicia Kingiana**, *Prain* [Proteaceae]; species *H. robustae*, Wall., proxima, differt foliis margine integris squamis hypogynis in cupulam margine dentatam connatis, perianthioque crassiore.

Arbor 15–20-metralis, caule 3–4·5 dm. crasso, ramis patulis, ramulis crassis laevibus, fusco-cinereis vel fere atris summis distincte angulatis; glaberrima. *Folia* sessilia vel subsessilia, coriacea, obovata vel elliptico-obovata, apice rotundata vel breve obtuse vel retuse acuminata, versus basin cuneatim attenuata, margine integra, 15–25 cm. longa, 6–11 cm. lata, supra pallide viridia, siccitate saturate olivacea, subtus siccitate purpureo-brunnea, utrinque opaca; costa crassa utrinque elevata, nervi laterales utrinsecus 10–12 imis fere a basi obliquis, ceteris arcuatim ascendentibus, venae transversae prominulae irregulariter areolatae. *Racemi* crassiores, rigidi, sub quoque folio vel e nodis defoliatis singuli, ad 30 cm. longi; pedunculi crassi 4–5 mm. longi pedicellos binos 4·5–6 mm. longos gerentes; bracteae bracteolaeque minutae, erectae, caducae. *Peranthium* in alabastro 3·5–4 cm. longum, crassum, apice angulatum; squamae hypogynae in cupulam margine minute dentatam 1–1·5 mm. longam connatae. *Stamina* filamentis latiusculis 2 mm. longis, connectivo lato, obtuse apiculato, antheris 3–3·5 mm. longis. *Ovarium* ovoideum, glabrum; stylus stigmate clavato incluso perianthio aequilongus. *Fructus* globosus vel ovoideus, utrinque leviter attenuatus, unolateraliter obtuse carinatus, 3–4 cm. longus, 2–3 cm. latus, pericarpio laevi 2 mm. crasso. *Semen* drupa conforme, testa membranacea.

Malay Peninsula. Perak: Near Larut, 250–300 m., *King's Collector*, 3714, 3881, 3617. Gunong Batu Pateh, 1200 m., *Wray*, 983, 1160.

657. **Helicia rufescens**, *Prain* [Proteaceae]; species nulli manifeste similis, ab *H. velutina*, Prain, quacum racemis pubescentibus congruit petiolis racemisque multo longioribus differt.

Arbor 18–24-metralis, caule 6 dm. crasso, ramis patulis, ramulis crassis fusco-cinereis summis rufo-tomentosis. *Folia* distincte petiolata, sub-coriacea, obovata vel late oblanceolata, apice acuminata, basi attenuata, margine integra, 15–30 cm. longa, 6–11 cm. lata, supra saturate viridia, siccitate saturate olivacea, juvenilia nervis costaque rufo-pubescentia mox glabra, subtus rubro-brunnescentia juvenilia dense rufo-pubescentia, utrinque opaca;

costa utrinque elevata ; nervi laterales utrinsecus 16–20, inferiores approximati paralleli rectiusculi, superiores plus minusve distantes, arcuati ; venae transversae irregulariter areolatae ; petiolus 3–4 cm. longus, basi pulvinatus, dense rufo-pubescens. *Racemi* sub quoque folio vel e nodis defoliatis singuli vel bini, 15–20 cm. longi, dense rufo-pubescentes ; pedunculi breves, 1 mm. longi, pedicellos binos 2 mm. longos gerentes ; bracteae bracteolaeque ovatae, minutae. *Perianthium* in alabastro 1–1·2 cm. longum, lobi sub anthesin spiraliter torti, intus glabri ; squamae hypogynae liberae, obtusae, glabrae. *Stamina* filamentis gracilibus 1 mm. longis, connectivo obtuso apiculato, antheris linearibus 2·5–3 mm. longis. *Ovarium* dense rufo-villosum ; stylus stigmate cylindrico sulcato incluso perianthio aequilongus. *Fructus* subglobosus, utrinsecus parum complanatus, flavido-brunnescens utrinque acutatus, 3 cm. longus, 2·5 cm. latus, 1·5 cm. crassus, rufo-tomentosus, demum glabrescens, pericarpio 2–3 mm. crasso. *Semen* drupa conforme, testa membranacea.

Malay Peninsula. Perak : Larut and Thaiping, 150–450 m., *King's Collector*, 4213, 4939, 5096, 8604. Waterfall Hill and Tapai, *Wray*, 2083, 3084.

658. **Helicia velutina**, *Prain* [Proteaceae] ; species nullo adhuc descripto apte comparanda ; ab *H. rufescenti*, Prain, quacum racemis pubescentibus congruit petiolis racemisque manifeste brevioribus differt.

Arbor 15–20-metralis caule 2·5–3·3 dm. crasso, ramulis crassis cinereis, striatis, summis minute cinereo-puberulis. *Folia* breve petiolata, chartacea, late oblanceolata, apice subabrupte acuminata, basi cuneata subdecurrentia, margine integra parum recurva, 10–20 cm. longa, 4–7 cm. lata, supra laete viridia, siccitate olivacea, subtus plumbea nisi costa parce pubescente glabra, utrinque nitidula ; costa utrinque prominula ; nervi laterales utrinsecus 14–16 supra impressi, subtus elevati recti, paralleles intra marginem anastomosantes ; venae irregulariter areolatae ; petiolus 1–1·5 cm. longus, basi pulvinatus. *Racemi* saepius e nodis annotinis singuli vel bini, 7 cm. longi, dense rufo-velutini ; flores dense congesti, in pedunculos perbreves vel glomeratim sessiles bini, ascendentes ; bracteae lineares, 7–8 mm. longae ; bracteolae lineares, 4–5 mm. longae. *Perianthium* in alabastro breve crasseque clavatum, 5 mm. longum, intus glabrum ; squamae hypogynae liberae, minutae, truncatae, glabrae. *Stamina* filamentis obsoletis, connectivo breve apiculato, antheris oblongis. *Ovarium* glabrum, ovoideum ; stylus crassus ; stigma clavatum. *Fructus* ignotus.

Malay Peninsula. Perak : Larut ; Gunong Bubu, 600–750 m., *King's Collector*, 7316.

659. **Philodendron Broadwayi**, *N. E. Brown* [Aroideae-Philodendreae] ; affinis *P. Schottii*, C. Koch (*P. lingulati*, Schott, nec C. Koch), sed internodiis longioribus et foliis triplo vel quadruplo latioribus oblongis vel ellipticis facile distinguitur.

Caulis scandens, glaber, internodiis 7–13 cm. vel ultra longis. *Foliorum* petioli 7–15 cm. longi, longe vel usque ad apicem late vaginati ; laminae 8–30 cm. longae, 5·5–12·5 cm. latae, oblongae, ellipticae vel elliptico-ovatae, obtusae, breviter cuspidatae, basi rotundatae, utrinque glabrae ; nervi primarii utrinque 6–9,

patentes, leviter curvati. *Pedunculi* solitarii, 3–4 cm. longi. *Spatha* inaperta (immatura ?) 7 cm. longa, basi leviter ellipsoideo-inflata et 1–5 cm. crassa, glabra.

West Indies. Island of Tobago; climbing upon a shrub in a cool shaded place at Englishman's Bay, April 15, 1912. *W. E. Broadway*, 3880.

As the names *Philodendron Schottii*, C. Koch, and *P. lingulatum*, C. Koch, appear to have been overlooked by Engler and other authors, and are not included in the *Index Kewensis*, it may not be out of place to record their establishment here.

P. lingulatum, C. Koch, was published in "Appendix Gen. et Sp. quae in Hort. Bot. Berol. coluntur," 1855, p. 2, which may have been issued at the end of 1855 or early in 1856. The species was founded upon *Arum lingulatum*, Linn., as to the diagnosis of Linnaeus and Plumier's figure (t. 37), which he quotes, but not as to the other references given by Linnaeus, and is unmistakably described by C. Koch. The same plant was described by Schott in 1856 as *P. dispar*.

P. lingulatum, Schott, Synop. Aroid., p. 77, was founded upon a totally distinct plant from that which C. Koch had described as *P. lingulatum*, but was evidently published nearly at the same time, or possibly a little later, as the copy at Kew was sent to Sir Joseph Hooker by Schott on March 25th, 1856. C. Koch, however, appears to have considered that his *P. lingulatum* had the prior claim to recognition, since in Ender, "Index Aroidearum," pp. 61 and 63, he retains *P. lingulatum*, C. Koch, and assigns the date 1855 to it, whilst to the *P. lingulatum*, Schott (which was certainly not published until 1856), the name *P. Schottii*, C. Koch, is given. In a criticism of Ender's "Index Aroidearum," however, Schott in "Oesterr. Bot. Zeitschr.," 1865, p. 115, states that *P. lingulatum*, C. Koch, and *P. lingulatum*, Schott, are one and the same plant. It is quite inexplicable how Schott could have made this mistake, as the two species are entirely different, and were so regarded by Schott himself, both in his "Synopsis" and "Prodromus Aroidearum."

Linnaeus, according to his diagnosis of the species, evidently founded *Arum lingulatum* upon Plumier's figure, although he erroneously adds to it as a synonym a reference to another species figured by Sloane. As C. Koch also founded his *P. lingulatum* upon Plumier's plant, and his description of it was possibly published before that of Schott, it appears to me that his name should be retained by preference, the following being the synonomy of the two species :—

P. lingulatum, *C. Koch*, in Appendix Gen. et Sp. Nov. quae in Hort. Bot. Berol coluntur, 1855, p. 2. *P. dispar*, Schott, Synop. Aroid., p. 79 (1856), and Prod. Aroid., p. 233. *Arum lingulatum*, Linn., Sp. Pl. ed. 2, p. 1371. *Arum scandens, maximum, flore flavescente*, Plumier, Pl. Amer., vol. i, p. 26, t. 37.

P. Schottii, *C. Koch*, in Ender, Index Aroid., pp. 63 and 61 (1864). *P. lingulatum*, Schott, Synop. Aroid., p. 77, and Prodr. Aroid., p. 225. *Phyllitidi scandenti affinis minor (et major) graminifolia, &c.*, Sloane, Voy. Jamaica, vol. i, p. 75, t. 27, figs. 2–3.

660. **Xanthosoma cordifolium**, *N. E. Brown* [Aroideae-Colocasieae]; affinis *X. sagittaefolio*, Schott, sed foliis obtusissime rotundato-cordatis et spadice organis neutris clavatis carente longe differt.

Herba perennis. *Foliorum* petioli 4·5–6·5 dm. longi, ad apicem vaginato-canaliculati, virides, purpureo-brunneis marginati; lamina deflexa, 4·5–6 dm. longa, 3·5–4 dm. lata, cordato-ovata, acuta, lobis basalibus obtusissime rotundatis, marginibus undulatis, supra viridis, subtus pallidior; venae primariae utrinque 8–10, costae basales in sinu breviter denudatae, pluri-ramosae. *Pedunculus* 20–25 cm. longus, 1 cm. crassus, viridis. *Spathae* tubus 6–6·5 cm. longus, ellipsoideus, viridis, purpureo-marginatus; lamina 15–17 cm. longa, 7 cm. lata, oblonga, acuminata, basi subreflexa, superne adscendens, concava, pallide flavescens, purpureo-marginata. *Spadix* 15–16 cm. longus, parte feminea 2·5–3 cm. longa cylindrica pallide viridi, parte neutra 4 4·5 cm. longa, cylindrica superne breviter angustata pallide purpurascente, organis neutris infimis truncatis (nec clavatis), parte mascula 8 8·5 cm. longa cylindrica acuta alba.

British Guiana. Described from a living plant sent from British Guiana in 1898 to the Royal Botanic Gardens, Kew, where it flowered in July of 1900 and 1901.

Xanthosoma pilosum, C. Koch, and *X. Holtonianum*, Schott. These two species properly belong to the genus *Caladium*, and have been so transferred in the Botanical Magazine, under t. 8402, where, however, the name *Holtonianum* has (by a printer's error) been spelt *Hottonianum*. They should in future be known as :—

Caladium pilosum, *N. E. Brown* (*Xanthosoma pilosum*, C. Koch).

Caladium Holtonianum, *N. E. Brown* (*Xanthosoma Holtonianum*, Schott).

XLIII.—THE FULLER'S TEASEL.

(*Dipsacus Fullonum*, L.)

W. Dallimore.

Early in the present year a communication was received at Kew from Mr. George E. North, of Messrs. Wm. North and Sons, teasel merchants, Gelderd Road, Leeds, respecting the increasing difficulty of obtaining a regular supply of teasels of English growth, and asking whether it would be practicable to cultivate the plant under glass, or whether a better cultural method could be suggested than the one now practised, whereby it might be possible to grow the plant as a paying crop with more certainty than at present, and so check the serious falling off in the production of teasel heads which has occurred during late years.

Subsequently I was instructed by the Director to visit Mr. North for the purpose of discussing the past and present positions of the teasel business, with a view to formulating suggestions on the lines indicated above, and the results of that interview and of the enquiries made elsewhere are embodied in the following notes.

Teasels of commerce are the dry flower heads of *Dipsacus Fullonum*, L., gathered about the time when the seeds are fully

grown. The plant is a well-known biennial which is widely distributed in Europe, and is included in the British Flora. During the first year of its life a tuft of bright green leaves, which may be anywhere between 6 and 15 inches long, is formed, and the following year a central stem rises to a height of from 3 to 6 feet. This branches freely, and each division is terminated with a flower head. The flowers, which open during July and August, are regularly interspersed with strong, wiry, curved bracts, which, when dry, have considerable elasticity. The uniform development of these bracts and their subsequent ripening decides the value of the heads.

A great deal of difference is noticeable in the size of the heads borne by individual plants. The central one which terminates the main axis is always the largest, and is sometimes called a "king teasel." The next in size are found at the ends of the principal branches and are called "queens;" whilst minor branches bear smaller heads, which are distinguished as "princes" or "buttons."

As is well known, teasel heads have been used for many centuries by cloth-workers for raising a nap on cloth, and although inventors have tried for generations to construct a machine capable of giving the same finish, nothing has yet been found to equal the teasel. For use, the heads are arranged on a revolving cylinder, over which the newly-made cloth passes in the opposite direction to that in which the cylinder is turning. In passing, the teasel hooks tear up the surface of the cloth without in any way injuring the material, whereas steel or wire hooks often cause flaws. As a successful finish to cloth depends entirely on the regularity and evenness of the teasel hooks, it will be seen at once that damage through bad ripening, or other causes, adversely affects the monetary value of the crop. An idea of the nicety with which the heads have to be arranged for different classes of work may be gathered from the fact that Messrs. North sort them into 70 different sizes before distributing them to their customers.

Although several countries include the teasel amongst their agricultural crops, it is usually regarded as a minor one, and the areas under cultivation are restricted, therefore a shortage in any one country results in an all-round rise in price. France has, perhaps, the largest acreage, and French-grown heads have a higher reputation than those grown in other countries. In addition to England and France, teasels are grown in Germany and the United States.

According to Syme, "British Botany," ed. 3, vol. iv, p. 248, the culture and use of the teasel was introduced to England by foreign artisans about the reign of Richard I., and the plant has been grown regularly since the days of Edward III. The crop, however, has always been looked upon as a precarious one, and its culture has been in the hands of comparatively few people. Somersetshire, Gloucestershire and Wiltshire formed the principal seat of the teasel-growing business in the British Isles from its earliest days until the cloth-manufacturing centres were moved to the Yorkshire coalfield. About that time teasel-growers moved northwards also, and teasel-growing in Yorkshire has been carried on more or less successfully to the present day; a sequence of bad

seasons has, however, decided the majority of growers to give up the business. In Somersetshire, at the present time, according to information kindly furnished by Mr. Thos. F. Plowman, the cultivation appears to be nearly confined to Ashill Forest, West Somerset, where the soil is a stiff cold clay, and much of the working is done by spade labour.

An early account of teasel-growing in the British Isles is given in Johnson's edition of "Gerard's Herball or Generall Historie of Plantes," published in 1633. Two varieties are referred to, "tame" and "wild," the former corresponding with the Fuller's teasel of the present day.

In 1640 John Parkinson, in his "Theatrum Botanicum," refers to three kinds of teasels, "garden or manured," "wild," and "cut-leaved." According to present day nomenclature these may be referred to *D. Fullonum*, *D. sylvestris*, and *D. laciniatus* respectively. To the first named Parkinson refers in the following words: "The first is onely manured and sowen in gardens or fields for the clothmakers use, by raysing the wooll of cloth with the crooked prickles of the heads, make it fit for their sheeres to cut it smooth and thereby leave a fine nappe thereon pleasing to all."

Philip Miller, in the first edition of his "Gardeners' Dictionary," published in 1731, recommends that teasels should be grown alone. The practice had evidently been followed of growing a thin crop of corn with the plants for the first year, such as is done in some places at the present time. He gives the yield as 150 staves to the acre and the price as 1*s.* a stave.

The Rev. Wm. Hanbury, in vol. ii, p. 126, of his "Complete Body of Gardening," published in 1771, describes three kinds of teasels, "fullers," "jagged-leaved," and "small-leaved," and gives the method of cultivation adopted for the first-named. The salient points are as follows: Seeds were to be sown broadcast at the rate of one to one and a half pecks to the acre in March. When the young plants were large enough to be seen well, they were to be thinned out to from 12 to 18 inches apart each way, and the ground between hoed over. Several subsequent cleanings, and thinning if necessary, were recommended, and the heads were to be cut during the second August of the plant's life. A good crop tied in bundles was at that time worth 8*l.* an acre.

A good account of teasel-growing in England is given by Johnson and Sowerby in "Useful Plants of Great Britain," pp. 139–140. Teasel cultivation in France is dealt with in the "Journal of the Royal Society of Arts" for December 15th, 1911, pp. 128–129; and a good account of teasel culture in the United States may be found in "Bailey's Cyclopedia of American Agriculture," vol. ii, pp. 636–638.

The cultural methods adopted by Mr. North are as follows:—

Land is hired from farmers for the cultivation of one crop at the rate of 6*l.* per acre per year. Ground which will produce good wheat is considered most suitable for teasels, and, when possible, a crop of wheat is followed by teasels; the ground being well worked but not manured. Seeds are drilled into the ground in March of one year for the succeeding year's crop. In June the ground is

weeded, and any vacancies which may occur in the lines made up. In July the ground is again weeded and the plants are thinned out. In October a further cleaning of the ground and loosening of the surface soil takes place. Nothing more is done until March, when the ground is again loosened. At this time the plants are finally thinned, the stronger ones being left about three feet apart each way. Those taken out are used to fill up any gaps caused by death through damp or frost during winter. In May a final cleaning is given, and during the next two months a strict watch is kept in view of a possible attack by caterpillars. The harvest takes place during August and September. When the time approaches, sheds with open sides and thatched roofs are erected in the fields, and in these the heads are dried. As the heads mature at different periods, the plants have to be gone over several times. They are cut with about six inches of stalk and tied up in handsful. These are then threaded on long poles and hung in the sheds for about five weeks to dry. They are then taken into a barn, sorted and tied up into staves or bundles ready for sale. A bundle of heads varies considerably in price, the poorer ones being as low as 35*s.* and the best ones as high as 24*l.* Some factories use about three bundles a month, and Mr. North estimates the annual value of the heads used in this country at about 15,000*l.*

For comparison with the method of cultivation adopted in England the following extracts bearing upon the cultivation in France and the United States are taken from the above-mentioned articles. In France the plant is found to thrive best in a light, gravelly soil, with a southern aspect. The seeds are sown in spring and the young plants well thinned out. In August they are transplanted into rows about 12 to 15 inches apart, and are kept well weeded during winter. Sometimes they are sown in the places where they are to remain, and a cereal is sown with them, so that some return may be obtained from the ground during the first year. In the following spring, as soon as the plants have attained a height of from 20 to 24 inches, a number of the side shoots are removed, from eight to twelve being considered sufficient for each plant to carry. Harvesting is commenced when the leaves begin to fall or to turn yellow. When dry the heads are packed in boxes containing from 25 to 100 each, all of which must be of uniform size and colour. The principal teasel-growing districts in France are said to be Bouches-du-Rhone, Vaucluse, and Seine-et-Oise. In 1909, 3690 acres of teasels were grown in the three districts, and 40,380 cwts. of heads were produced which were valued at 51,237*l.*

Teasel cultivation in the United States appears to have commenced about 1840. At that time William Snook, a resident of Onondaga County, New York, paid a visit to his home in England and took back seeds. He afterwards imported teasel growers from England and established a small but important industry, which, according to the previously mentioned article, is still retained, although the industry has been kept within a radius of ten miles from the place where it was started. The "Diplomatic and Consular Report," No. 4148 (1907), however, refers to teasels being grown to a small extent in Clackamas County, Oregon. The cost of growing is there given as twopence a pound for dried heads

and the selling price as fourpence a pound. In America it is usual to sow the seeds in drills 2 to 3 feet apart with a thin crop of corn. The corn is gathered and the straw left standing to afford some protection from snow during winter. The plants are eventually thinned to eight or ten inches apart in the rows and harvesting takes place in a similar manner to that adopted in England. The average crop is 100,000 heads to the acre (about the same as in England), and the price in New York State is from 20 cents to one dollar a thousand, although it may drop to 10 cents or rise to two dollars. One thousand heads are said to weigh six pounds.

Regarding teasel culture in England there appear to be two critical periods. One is during winter when many plants are killed by inclement weather and the other is during the harvest when a period of wet weather may partially or wholly ruin the crop. On account of this Mr. North suggests indoor cultivation. In support of his suggestion he has grown a few plants indoors and produced heads which other experts pronounced to be equal in quality to the best French heads. On the other hand his experiment was not on a sufficiently large scale to be able to form an opinion as to the financial result. In the absence of experience one would be inclined to consider that such a scheme would be a financial failure for the gross average income from an acre of teasels is said to be about £70, and this after the ground has been occupied for 18 months, including two summers. An acre of glass built in the cheapest possible way would mean a considerable outlay; the soil would require to be renewed frequently, or additional expense would have to be incurred by building portable frames; wear and tear would be a heavy item; the plants would need more natural attention than when grown outside and there would be a greater risk of injury by insect pests. The method of culture might, however, prove successful, but one would recommend caution and thorough work of an experimental character before an extensive scheme were undertaken.

There appears good reason to suppose that better results might be obtained by moving the cultural area from Yorkshire and the western counties to Essex and Hertfordshire and perhaps Norfolk and Suffolk. These counties have a drier winter and usually a sunnier summer and autumn, whilst there is plenty of suitable ground. It also seems that experiments might be conducted with a view to obtaining a race which would stand the winter well, for plants full of vigour in spring might be expected to mature earlier than those which had suffered in winter and by advancing the harvest by one or two weeks the crop might sometimes be saved. Experiments ought also to be made with a view to saving the ground for one summer. By sowing seeds thickly on a small area of ground, a crop of corn could be taken from the rest and the teasels planted out in autumn. What saving could be effected by this means, or whether there would be any saving, can, of course, only be determined by experiments. Efforts have been made to breed teasels yielding heads of particular sizes but without any definite results, and Mr. North finds from his experience that the best plan is to select seeds from well grown heads, then all the sizes can be obtained from the crop.

Should any farmer wish to experiment with the cultivation of teasels in the eastern counties, Mr. North has expressed his willingness to supply the necessary seed free of cost.

The following Return, showing the value of teasels imported into the United Kingdom from France, Germany, and the United States during the years 1910 and 1911, has been supplied by the Statistical Office of the Custom House, London.

Country whence consigned.	Year 1910.	Year 1911.
	£	£
France	4,987	8,681
Germany	110	295
United States	1,326	349

Briefly, the conclusions arrived at may be summarised as follows:—

According to the present outlook a steady demand for teasel heads is likely to continue, although it is doubtful whether there is much room for expansion in the world's production.

The cultivation of the teasel ought not to be allowed to drop in England, and experiments should be made with a view to finding the most suitable localities, the most economical method of culture, and a strain of plants which will winter well.

Farmers in the most suitable districts should be encouraged to undertake teasel-growing on a small scale, but it would be unwise for anyone to make it the sole, or even the principal crop, for although a well-gathered harvest of heads may be expected to result in good prices, so much depends on the weather at harvest time, that the crop must always be looked upon as risky.

Glass-house culture is worth a trial but it is probable that it will be found to be too expensive to be generally adopted.

XLIV.—MISCELLANEOUS NOTES.

Mr. Frank Birkinshaw, a member of the gardening staff of the Royal Botanic Gardens, has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Assistant Agricultural Superintendent in St. Vincent, West Indies.

W. R. Guilfoyle.—We regret to notice the death, on June 26th last, of Mr. W. R. Guilfoyle, for many years Director of the Melbourne Botanic Garden, Australia.

He was born in Chelsea, but went out to Australia early in life, and his first botanical appointment of importance was as botanist to H.M.S. Challenger, during her cruise among the South Sea Islands, in 1868.

In 1873 Mr. Guilfoyle succeeded the late Baron Ferdinand von Mueller as Director of the Melbourne Gardens, and it has been owing to his skill in landscape gardening that the gardens have attained their present beautiful condition.

Landscape gardening was his particular métier, and appears to have been an inherited faculty from his father, who laid out many important gardens in England and in Sydney.

During the thirty-six years of his Directorship, which he resigned in September, 1909, the changes in the garden were profound; lawns have replaced spaces formerly wilderness, vistas have been opened up which have given a great air of spaciousness to the grounds, and swamps have been transformed into lakes. In addition to his purely garden work the plant collections were enlarged to 14,000 species, and a special collection of Australian Acacias and Eucalypts was formed.

The garden, to which he was devoted and which owes so much to his skill and foresight, forms a lasting memorial to his work.

Guide to the Royal Botanic Gardens.—The "Official Guide" to the Royal Botanic Gardens has long been out of print, and to meet the need of some publication dealing with the collections of living plants a new guide entitled a "Popular Official Guide" has been prepared and recently published.

The guide consists of 104 pages of text with map and index. The map and key plan is taken from the latest survey and indicates the position of the more important collections. Wherever reference is made in the text to particular plants its approximate position on the map is indicated and can easily be found by means of the squares into which the map is divided.

The guide is divided into sections. Means of approach to the gardens and the general arrangement of the plants occupy the opening paragraphs, which are followed by a short Historic Notice of about twelve pages, in which the gradual development of the gardens is traced.

The collections are then described in some detail under the headings "Botanic Gardens," comprising the portions of the grounds near the main gate, "Glass Houses," "Museums," and "Arboretum." Owing to the extent of the gardens no particular route is suggested for visitors to follow, but as far as possible the plants of interest on different lawns are described in consecutive order, and cross references to similar plants in other parts of the gardens are given.

The glass houses are described in order of their numbers. In the portion devoted to the museums only the more important products of economic interest are mentioned, and as a rule only those of such plants as may be found among the collections of living plants. For fuller details the guides to the different museums should be consulted.

The Arboretum is described under four headings for the convenience of visitors. The first portion lies between the Kew Road and the Holly Walk, which contains especially the collection of *Leguminosae* and *Rosaceae*. The Pinetum, where the collection of Conifers is to be found, the Lake, and finally the portion of the Arboretum lying between the Sion Vista and the Thames.

Here are to be found the Oaks, Elms, Poplars, Birches, &c., as well as the Bamboo Garden, Azalea Garden and Rhododendron Dell.

Botanical Magazine for August.—The plants figured are *Hydrangea Sargentiana*, Rehder (t. 8447); *Aloe Steudneri*, Schweinf. (t. 8448); *Muehlenbeckia complexa*, Meisn. (t. 8449); *Pycnostachys Dawei*, N. E. Brown (t. 8450); and *Agave disceptata*, J. R. Drumm. (t. 8451).

The *Hydrangea* is one of the many new Chinese plants discovered by Mr. E. H. Wilson and sent by him to the Arnold Arboretum. This species is characterised by the conspicuous covering of bristly hairs present on its stems and petioles and is thereby easily distinguished from its nearest ally, *H. Rosthornii*, Diels. Though a native of Western Hupeh, at elevations of from 5,000 to 6,000 feet, several young plants at Kew, which were raised from seed presented by the Director of the Arnold Arboretum, were killed during the winter of 1909–10.

Aloe Steudneri is a particularly handsome species, with a dense rosette of leaves about 2 feet long, slightly branched peduncles 3 feet high, and pendulous flowers about 2 inches long, deep red, rose-pink, and dark yellow. It is a native of Eritrea and Abyssinia, and was first introduced into European gardens by Prof. Penzig of Genoa, who presented a plant to Kew in 1896. This has not yet flowered, the material for the figure having been received from the garden of Lady Hanbury at La Mortola.

Muehlenbeckia complexa is a New Zealand species which was first received at Kew from the late Rev. W. Colenso in 1842, and is now often met with in gardens in the warmer parts of the British Islands. It has slender climbing stems which form dense masses when allowed to grow over shrubs or rocks, small leaves rather variable in shape, and flowers of which the perianth in fruit is accrescent and becomes glistening white. The figure was prepared from material obtained from Herm Island, Guernsey, by Mr. D. Hill, of Watford.

Pycnostachys Dawei is a handsome winter-flowering Labiate from Uganda, whence seeds were sent to Kew in 1905 by Mr. M. T. Dawe. Plants raised from these seeds flowered in January, 1906. It has now been figured from a specimen received for identification in December, 1911, from Dr. A. R. Wallace. The deep blue flowers, arranged in dense heads, are liable to injury at Kew from fogs.

The *Agave* was presented to Kew in 1893 by the late Mr. W. B. Kellock. It was received under the name of *A. Leopoldi*, Hort., and was believed by Mr. Kellock to be a hybrid between *A. filifera*, Salmdyck, and *A. princeps*, Hort. The plant has now flowered, and proves to be a valid species most closely allied to the group which includes *A. geminiflora*, Scannag., and *A. angustissima*, Engelm.

Botanical Magazine for September.—The plants figured are *Dendrobium Imthurnii*, Rolfe (t. 8452); *Columnea glabra*, Oerst. (t. 8453); *Berberis verruculosa*, Hemsl. & E. H. Wils. (t. 8454); *Chironia laxa*, Gilg (t. 8455); and *Primula Wattii*, King (t. 8456).

The *Dendrobium* is a distinct new species which was discovered in the island of Efate, one of the New Hebrides, by Sir Everard

im Thurn, who presented to Kew the plant from which the material for the figure was obtained. It is remarkable in its pseudobulbs, which are sometimes over four feet high. Its flowers are of medium size, white, with lilac marks on the lateral lobes of the labellum.

The handsome *Columnea* is a native of Costa Rica, where it appears to be one of the commonest species of the genus, and is found at elevations of from 5000 to 6000 feet. It is a true epiphyte, and has elliptic-oblong leaves 1–1¼ in. long, and scarlet hirsute corollas which when fully expanded are about 3 in. long. The figure was prepared from a plant acquired from Mr. Lemoine of Nancy in 1907.

Berberis verruculosa is a Chinese species discovered on the mountains around Tatien-lu in Western Szechuan by Mr. E. H. Wilson when collecting for Messrs. J. Veitch & Sons, who presented to the Kew collection the plant from which the specimen figured was procured. It appears to be very hardy, and forms a dense dwarf bush with stiffly arched branches and dark lustrous foliage. Its flowers are yellow and are rather large for a *Berberis*, and its oblong-ellipsoid berries are purplish-blue, about ½ in. long. The specific name has reference to the densely verruculose branches.

Chironia laxa is a pretty species of which a plant flowered last year in the Cambridge Botanic Gardens, where it had been raised from seed sent from Tembuland, Cape Colony, by Canon Mason. The material for the figure was received from Mr. Lynch. This species resembles in foliage the well-known *C. linoides*, Linn., but the pale magenta corollas have ovate-lanceolate subacuminate lobes.

Primula Wattii, a Sikkim species, belongs to the section *Soldanelloideae* which includes *P. Reidii*, Duthie, *P. soldanelloides*, Watt, and *P. uniflora*, Klatt. It has a scape about 4 in. high, bearing a dense head of violet flowers with a white mealy eye, and is distinguished from its allies by the bronze tint of its buds, the very wide calyx with irregularly toothed lobes, the rather large white mealy eye of the corolla, and the minute pistil. The drawing was made from a plant lent to Kew for the purpose by Messrs. R. Gill & Son, Falmouth.

Spices.*—In the Introduction to this recently published work Mr. Ridley very rightly observes "that the greater part of the spices that have been valued by man are derived from the Asiatic Tropics," and it would also be difficult to find a work of fiction or travel bearing upon the East that does not contain some reference to the subject. Mr. Ridley, from his long connection with the Eastern Tropics, writes with authority, and has produced a work of great value—not alone to the planter, but to those whose business lies on the commercial side of the question.

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* "Spices," by Henry N. Ridley, F.R.S., F.L.S., Director of Botanic Gardens, Straits Settlements. Macmillan & Co., 1912.

The historical notes are full of interest, and each subject is fully dealt with. Such matters as soils, cultivation, diseases, insecticides, fungicides, collection of the product and its preparation for commerce, being included.

The work runs into some 250 pages, and is well printed, but some of the illustrations are unworthy of inclusion. There is one omission, namely, that of the Caraway (*Carum Carvi*), which is largely produced in some European countries, and is most certainly an important spice ; also, it is not conclusive that Corianders are not still produced in this country on a commercial scale.

J. M. H.

Sisal in Papua.—The following remarks from a sisal expert in Queensland, reporting on a visit to a plantation in Papua, have been sent to Kew by a correspondent :—

" Sisal in Queensland can for the present be counted out ; labour is too uncontrollable, now too costly ; added to which there is not enough labour in the country for the growing existing industries.

" The sisal position in Papua is as yet in the embryonic stage ; there are several plantations with large areas, but at the present moment only a little over 2000 acres have been planted ; how much more will be planted I am unable to say, as the country does not seem to be going ahead very rapidly. Climate, soil, and conditions are favourable, but though there is room for very great expansion, only certain limited areas of the country are suited to sisal-growing. These areas are all on or very near to the coast, in the dry zones, of which there are several in New Guinea ; and as the climate in these zones is very good indeed, sisal-growing is a very good industry for Europeans to engage in in Papua. I do not think this kind of country is found in the German territory, and as yet the Dutch territory is practically unexploited and unknown. The known part of the British territory is for the most part very broken and mountainous, with rich soil on both the mountains, and in more or less narrow valleys."

Eucalyptus.—Mr. R. de Noter, of the Station Horticole d'Acclimatation, Bondy, Seine, has presented to the library a copy of a brochure published by Mr. A. Challamel, Rue Jacob, 17, Paris, comprising a series of articles on *Eucalyptus* which, during 1911 and the early months of the current year, he contributed to the Bulletin mensuel du Jardin Colonial et des Jardins d' Essai des Colonies (L'Agriculture pratique des pays chauds), Nos. 101–107, though no statement to the effect that the articles have appeared before is made in the brochure itself. The full title of the work is " Les *Eucalyptus* : Culture, Exploitation, Industrie, Propriétés médicinales". It consists of 119 octavo pages, with 37 figures mostly showing flowering and fruiting branchlets of certain species, and the price we understand is 5 francs.

The work is intended for the planter who, it is thought, in view of the fact that so much of the literature on the genus is scattered

through numerous publications, will find in it a volume easily accessible ; and as the author has spent ten years in cultivating and studying the many species which have been introduced into Algeria, where considerable success has rewarded the efforts put forth in establishing *Eucalyptus* plantations, his remarks as to the species which flourished or otherwise, and the cultural details which are supplied as the outcome of his own experience, should make his work of value to all who are interested in the planting of Eucalypts. Whether or not Mr. de Noter is aware of the excellent bulletins and circulars issued by the United States Department of Agriculture, and the Agricultural Experiment Station of the University of California does not appear. We refer to them below as to English-speaking people they specially appeal, for in them they have in their own language a valuable record of facts relating to the *Eucalyptus*, mainly as grown in the United States, which should be carefully considered by all who would venture on planting species of this important genus, concerning which, for commercial purposes, much experimental work, in selecting the most suitable species and the sites and climates best adapted for them, remains to be done.

Many allusions to the amelioration of the hygienic conditions of districts where the *Eucalyptus* has been planted are made by Mr. de Noter, and in this direction, we are inclined to think, he claims far too much for it, and in his enthusiasm overlooks some well-known facts which weigh heavily against his assertions. Much appears to have been done in Algeria in improving the climate of localities where malaria was often encountered, but whether the improvement has been effected entirely, or even partly, by the *Eucalyptus* planted there must be, in the presence of evidence on the subject before us, a matter of doubt. Mr. de Noter, however, seems to be quite satisfied as to what the plant has done, and is sanguine as to what it will do, in rendering malaria-stricken regions habitable and healthy to man. In Australia, he says, fever is unknown. It certainly should be if the *Eucalyptus* is performing the functions claimed for it by some writers. Yet Professor Liversidge, formerly of the University of Sydney, has drawn attention to the fact that for many years fevers have prevailed with great intensity in the *Eucalyptus* forests of their native land. With reference to the question of planting *Eucalyptus* in order to improve the hygienic conditions of certain localities, the article which appeared in the *Kew Bulletin*, 1903, pp. 1–10, should be consulted.

But, apart from this, the genus *Eucalyptus* is in many ways eminently important. For timber, tanning material, and oil, it becomes more and more valuable. Quite recently (*see* Nature, lxxxvi, p. 584), Mr. R. T. Baker, Curator of the Technological Museum, Sydney, who, in collaboration with Mr. H. G. Smith, published in 1902 an admirable account of the genus, dealing especially with its essential oils, informed Sir William Thiselton-Dyer that phellandrene oils—the term applied by chemists to oils which have been discarded owing to the adoption in Australia of the British Pharmacopoeia standard, which requires that all eucalyptus-oil offered for sale should contain not less than 50 per cent. of eucalyptol—for a time

regarded as almost useless, are now in great demand in mining operations. These phellandrene oils, which certain gum trees produce in greater quantities than other oils, yield the highest percentage of concentrates when employed on the "tailings" containing particles of minerals which in the past it has not been possible to extract profitably and satisfactorily. This discovery will, no doubt, add still greater importance to the genus as a source of oils.

We append the titles of the publications on *Eucalyptus* which, in addition to Mr. de Noter's work, are especially valuable to those who are interested in cultivating it on a commercial scale :—

1. **McClatchie, A. J.** Eucalypts cultivated in the United States. (U.S. Dept. Agric. Bureau of Forestry. Bulletin 35.) Washington (Government Printing Office), 1902. 106 pages and 91 plates. It includes a useful bibliography.

2. **Zon, R. & Briscoe, J. M.** Eucalypts in Florida. (U.S. Dept. Agric. Forest Service. Bulletin 87.) Washington, 1911. 47 pages and 5 plates.

3. **Ingham, N. D.** *Eucalyptus* in California. (Agric. Exper. Station, Berkeley, California. Bulletin 196.) Sacramento, 1908. 114 pages and 69 figures.

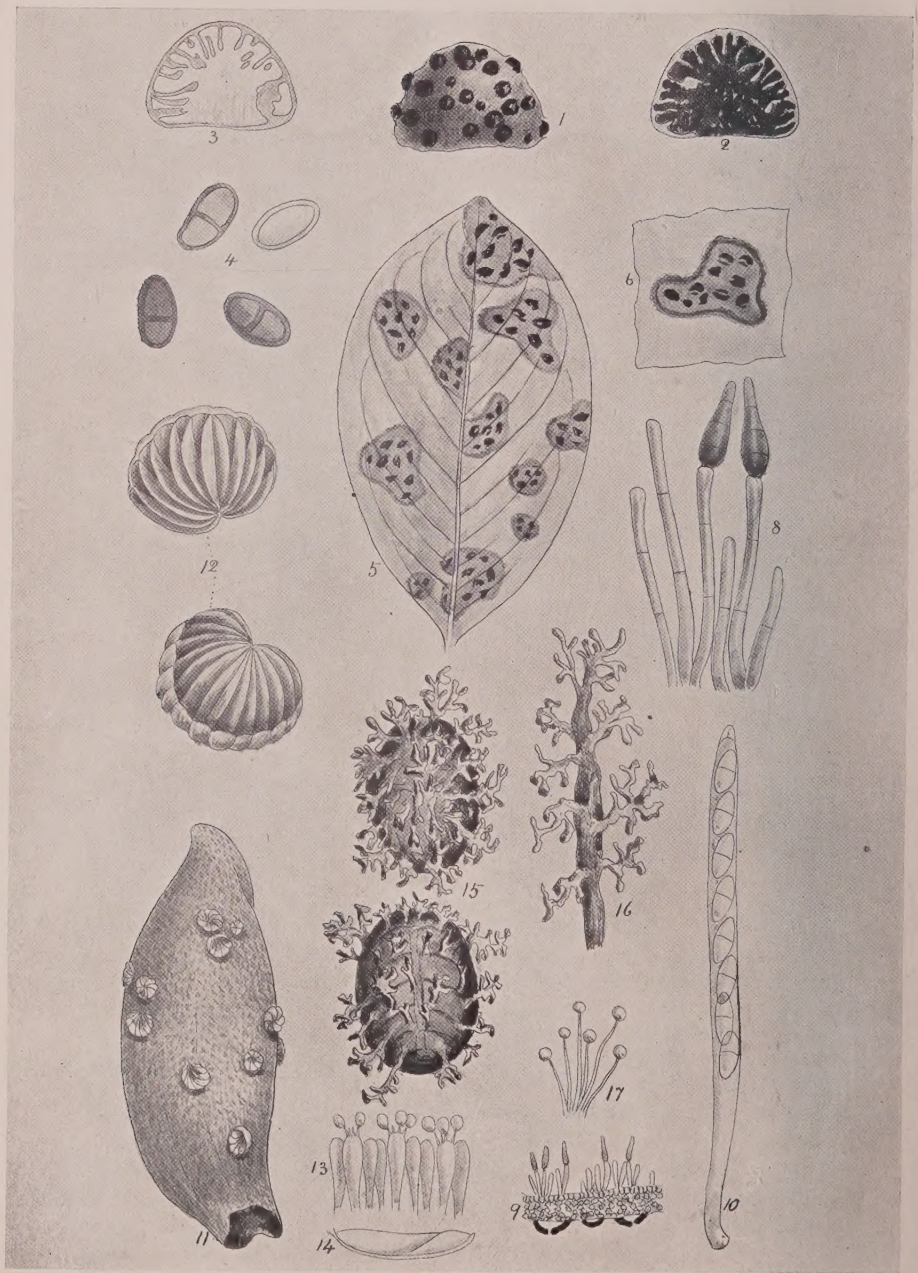
4. **Kinney, Abbot.** *Eucalyptus.* Los Angeles, California (Baumgardt & Co.), 1895. 298 + vi. pages and 29 plates.

S. A. S.

St. Vincent Agricultural Department.—We learn that the proposal brought forward by the Administration for the reorganisation of the Agricultural Department in St. Vincent has been passed by the Legislative Council.

Under the new Scheme which is to come into operation on October 1st, (1) The Agricultural Department is to be reorganised. (2) There is to be an alteration in the system of control of the Central Cotton Ginnery by which the Agricultural Superintendent is relieved of the work of supervision and the control is to be placed under the Superintendent of Crown Lands; the Agricultural Superintendent, however, to be placed on the Advisory Committee of the Ginnery. (3) The system under which the Agricultural School is conducted is to be altered so as to bring it into line with that which obtains in Dominica and St. Lucia.

Other changes concerning the Grammar School, Girls Secondary School, &c., are to be carried out in consequence of the alteration with regard to the Agricultural School, which should result in greater efficiency in the educational system of the Colony.



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